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THESIS

COMPUTER PROGRAM
FOR
CONCEPTUAL HELICOPTER DESIGN

by

Robert Lee Drake

September 1986

Thesis Advisor: D. M. Layton

Approved for public release: distribution unlimited.

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The conceptual phase of helicopter design requires that many calculations and iterations be completed. Often specifications are exceeded in the latter stages of the design, requiring a complete rework of the design to bring these specifications within limits.

This thesis develops a program to be used in the Helicopter Design - AE-4306 course taught by the Department of Aeronautics at the Naval Postgraduate School, Monterey, California to alleviate many of the tedious calculations required in conceptual design development. This program provides the student with the ability to perform trade-off studies to enhance design parameters.

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Computer Program for Conceptual Helicopter Design

by

Robert L. Drake
Lieutenant, United States Navy
B.A., University of Louisville, 1974

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN AERONAUTICAL ENGINEERING

from the

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September 1986

ABSTRACT

The conceptual phase of helicopter design requires that many calculations and iterations be completed. Often specifications are exceeded in the latter stages of the design, requiring a complete rework of the design to bring these specifications within limits.

This thesis develops a program to be used in the Helicopter Design - AE-4306 course taught by the Department of Aeronautics at the Naval Postgraduate School, Monterey, California to alleviate many of the tedious calculations required in conceptual design development. This program provides the student with the ability to perform trade-off studies to enhance design parameters.

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I. INTRODUCTION

A. BACKGROUND

Helicopter Design - AE-4306 taught by the Department of Aeronautics at the Naval Postgraduate School, Monterey, California requires the student to perform a conceptual design study for a specific mission-capable helicopter. In the design process the conceptual study is but one of five phases incorporated into the actual design of a helicopter. During the conceptual stage, configuration types are compared, size and cost estimates are made, feasibility studies are made and recommendations for follow-on work are given. Due to course time constraints, limits are established and certain assumptions made to aid in working within this restriction [Ref.1 and Ref. 2]. In completing the conceptual phase of design many steps must be taken, resulting in a trial and error approach which involves the manipulation of many equations and at times lengthy iterations. Computerization, which eliminates time consuming manual calculations, is a solution to the time constraint problem.

B. GOALS

The major objective of this project was to develop a program that is interactive with the student, one which uses the same decision making process as in the Helicopter Design Manual [Ref. 1], but which greatly reduces the time needed to make necessary calculations. With the current availability of personal computers (PC) to students at the Naval Postgraduate School, the program was to be designed to be used on these machines, eliminating dependence upon the school's mainframe computer.

This program is to be used by helicopter design students to enhance their design projects by allowing them to be done in a more efficient and timely manner. This will provide students with the opportunity to further optimize their projects. The program will also have the ability to be altered at a later date as helicopter design trends change.

II. APPROACH TO THE PROBLEM

A computer and a language had to be selected prior to program design. The IBM PC style of system was chosen due to its popularity and availability. The language selected was BASIC, chosen for its simplicity, ease of use with a PC and wide general public knowledge thereof. This makes future alterations of the program a simple task.

The general format of the program needed to closely follow Reference 1 to maintain continuity with design course objectives. A menu-driven approach provided ease of program operation.

Program documentation or a user's guide was developed to direct the student in the use of the program. Diverse levels of computer knowledge needed to be considered in the user's guide to accommodate possible first time computer users.

The major limitation encountered was the language selected. BASIC provides only 64 Kbytes of memory in which the program, arrays, variables and space for all loops must reside. Due to the size of this particular program 64 Kbytes became very restrictive, requiring some alterations.

III. THE SOLUTION

An AT&T PC 6300, IBM compatible computer, was used to develop the program. The AT&T version of BASIC [Ref. 3] was the language used. The menu-driven format was designed with a developmental application software [Ref. 4].

The format of the program emulated that of Reference 1, chapter by chapter and section by section. This format allows easy modifications to the program as changes to Reference 1 are made.

The size restriction of the basic language forced the breakup of the program into eleven separate programs. This provided a program for each chapter, with the eleventh program acting as the main program and containing the main menu (Figure 3.1). Passage between each program was performed with a BASIC chain command, which also allowed all variables to be passed. Once the size problem was overcome, the developmental software was implemented to design the menus used to direct the program.

Each chapter program was designed to closely follow the format of Reference 1 with one exception. In chapter five the first section of the computer program is a rotor blade optimization program. This program allows analysis

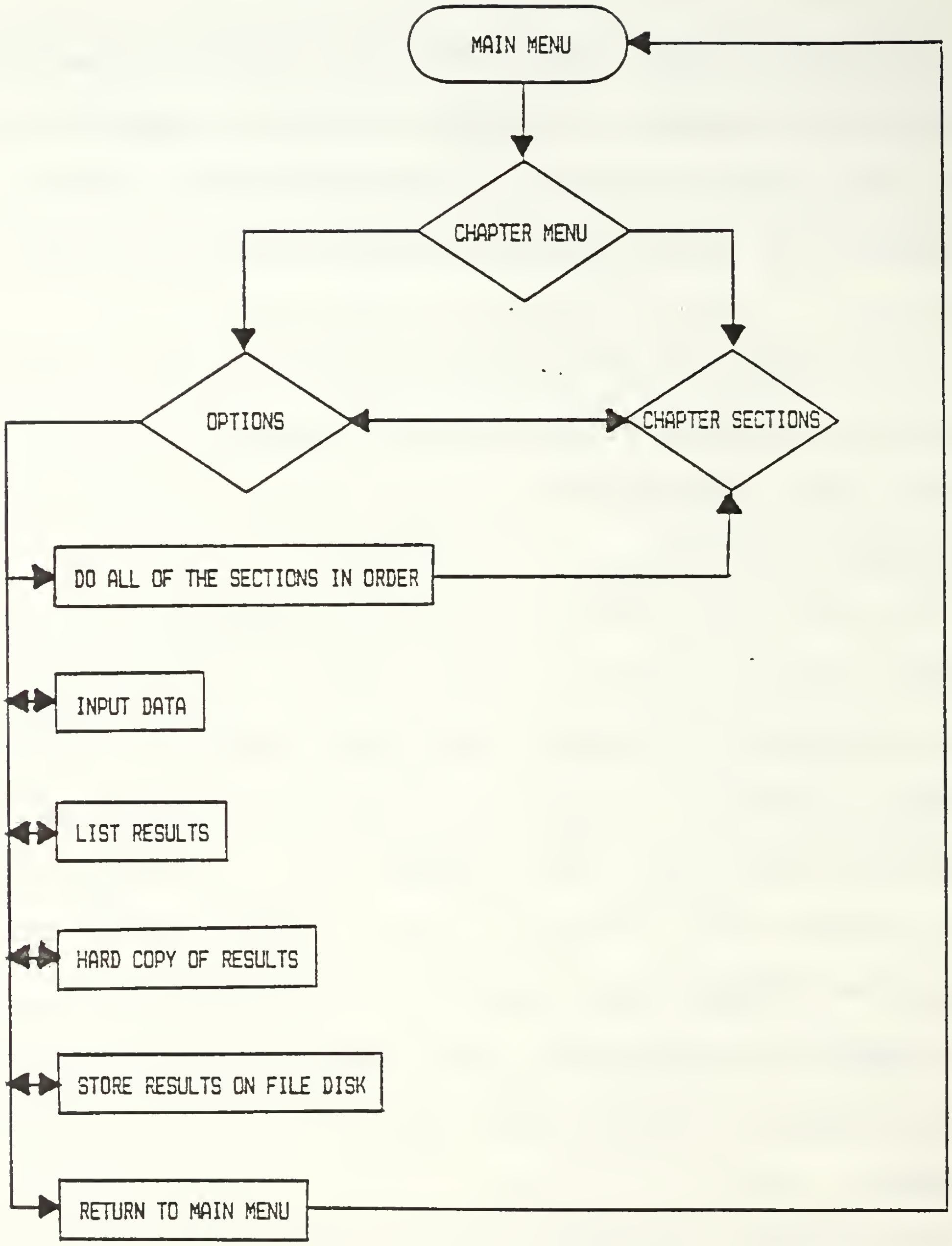

Figure 3.1 Program Flowchart

of up to five different rotor blades to determine which is the most efficient for the design being considered. This analysis requires the blade airfoil section data (i.e., lift curve slope, section drag coefficient, critical mach number, stall angle) which may be obtained from the Theory of Wing Sections [Ref. 5].

An option section was provided in each chapter menu to give the user the ability to print out the chapter results, list the chapter results on the screen, input data if calculations were done previously, store data on the file disk and return to the main menu. All printouts are provided in the format required by the Helicopter Design - AE-4306 course.

IV. RESULTS

The program covers all of Reference 1 and provides all necessary results required for the Helicopter Design - AE-4306 course. The program affords the student the ability to perform trade-off studies on his design to optimize specification parameters. The ability to observe helicopter performance changes with alterations in variables such as rotor blade dimensions, main rotor rotational velocity, number of main rotor blades, tail length, tail rotor parameters, etc., will enhance the student's knowledge of the subject.

A sample design of a heavy transport helicopter is provided in Appendix A. This contains results from the program as well as results from hand calculations for this particular design. The results from both methods are identical.

Appendix B contains the user's guide for the program. It was written to provide assistance for users of all levels of PC knowledge. This manual contains all information necessary to effectively use the program.

V. CONCLUSIONS AND RECOMMENDATIONS

This program gives the student the ability to perform several iterations of the design being developed. This will show the student how parameter changes affect the overall design, thus gaining a more in depth knowledge of helicopter performance.

Incorporation of wind tunnel work done by Witt [Ref. 6] and Sargent [Ref. 7] with the aid of calculations utilizing empirical data [Ref. 8] should be strongly considered. Due to the great time reduction provided by the program in the completion of Reference 1 requirements, wind tunnel work could be included to obtain equivalent flat plate area data and blade section characteristics.

A plotting routine could also be included with the program. Chapter Five results would be plotted to show the induced, profile, parasite and total power characteristics.

APPENDIX A

HAND CALCULATION AND PROGRAM RESULTS FOR THE HEAVY TRANSPORT HELICOPTER

A. HAND CALCULATION RESULTS

1. Chapter Two Results

Rough estimate gross weight = 33600
Manufacture's empty weight = 22000
Maximum tip velocity = 725.9785
Main rotor radius = 33.94851
Rotational velocity = 21.38469
Thrust coefficient = .009579
Advance ratio = .3487248
Blade solidity = .1028858
Number of main rotor blades = 6
Main rotor chord = 1.8288
Main rotor aspect ratio = 18.56291
Average lift coefficient = .54
Blade drag coefficient = .009
Lift curve slope = 5.73

2. Chapter Three Results

Main rotor total power HOGE = 3454.783
See Figure A.1 for section 3.2 component weights
these results obtained using Reference 9
Section 3.2 new gross weight = 37710.35
Disk loading = 10.41524
Figure of merit = .8078
Percent induced power = 82.556
See Figure A.2 for section 3.5 component weights
these results obtained using Reference 9
Section 3.5 new gross weight = 39658.52
See Figure A.3 for section 3.8 component weights
these results obtained using Reference 9
Total power HIGE = 3665.336
Equivalent flat plate area = 46.33785
Calculations at 60 knots give the following:
Main rotor induced power = 1721.21
Main rotor profile power = 750.96
Main rotor parasite power = 103.98
Main rotor tip mach = .741

3. Chapter Four Results

Tail rotor radius = 8.42
Tail rotor RPM = 918.93
Tail rotor aspect ratio = 6.5
Number of tail rotor blades = 4
Tail length = 41
Tail rotor total power = 371.70
Calculations at 60 knots give the following:
  Tail rotor induced power = 44.84
  Tail rotor profile power = 120.76
  Tail rotor total power = 165.60
  Tail rotor tip mach = .817
Tail rotor solidity = .195883
Vertical stabilizer planform = 44
Vertical stabilizer AOA = 9.83
Vertical stabilizer EFPA = 4.116
Vertical stabilizer addition to parasite power = 73.89

4. Chapter Five Results

Main rotor blade twist angle = -10
Calculations at 60 knots give the following:
  Alpha(90) = .660
  Alpha(270) = 6.10
Calculations at 60 knots give the following:
  Alpha(270) = 15.616
  Ps = 344.32
  M90 = .87667
  Mcrit = .851632
  Pm = 0.0
  Total power required = 3577.3
Power required at Vmax SSL = 3577.3
Power required at Vmax at ALT = 3544.97
Power required at hover ceiling = 7760.25
Maximum RSHP required = 7760.25
Power with straight-in inlets = 7915.458
Engine shaft horsepower required= 8978.21

5. Chapter Six Results

Number of engines = 2
Availability engine A = .57378
Maintainability engine A = .29836
Reliability engine A = .99781
Installation weight engine A = 930
Installation weight engine A = 892.8
Transmission weight = 5000
New total power HOGE = 4681.426
New disk loading = 11.11586

New figure of merit = .82065
New percent induced power = 83.92845
Percent difference in total pwr = 1.33
Percent difference in weight = 1.03

6. Chapter Seven Results

Fuel flow (military) = 4082.16
Fuel flow (normal) = 3485.4
Zero horsepower intercept SSL = 238.324
Zero Horsepower intercept ALT = 212.854
Phantom horsepower = 543.132
Maximum range:
- Velocity from Figure A.4 = 138
- RSHP required = 3223.899
- Referred horsepower = 3767.032
- Fuel flow required = 1652.951

Maximum endurance:
- Velocity from Figure A.4 = 87
- RSHP required = 2502.347
- Referred horsepower = 3045.480
- Fuel flow required = 1336.339

Cruise fuel flow at SSL = 1677.498
New fuel weight = 4714.015
New gross weight = 40961.09

7. Chapter Eight Results

Percent difference in design gross weight = .73
Difference in specification gross weight and design gross weight = 1038.914
Hover power for design gross wt.= 4803.413
Best rate of climb airspeed = 87
Maximum rate of climb = 6259.86
From program:
- Maximum hover altitude = 9140
- Service ceiling = 16410

Body width = 8.9
Body height = 8.9
Fuselage length = 54.94

8. Chapter Nine Results

No calculations required for this chapter.

9. Chapter Ten Results

See Figure A.5 for component costs these results obtained using Reference 9

Total cost = 5362134

```
ROTOR WEIGHT                                 5266.632

TAIL ROTOR WEIGHT                            377.6182

TAIL STRUCTURE WEIGHT                        262.8103

BODY WEIGHT                                  4920.282

LANDING GEAR WEIGHT                          1101.181

NACELLE WEIGHT                               338.2442

ENGINE WEIGHT                                3491.853

DRIVE TRAIN WEIGHT                           2471.216

FUEL TANK WEIGHT                             316.069

FLIGHT CONTROL WEIGHT                        1233.494

AUX POWER WEIGHT                             139

INSTRUMENT WEIGHT                            168.6002

HYDRAULICS WEIGHT                            197.4284

ELECTRICAL WEIGHT                            602.9511

AVIONICS WEIGHT                              325

FURNISHINGS WEIGHT                           387.1861

AIRCON/DEICE WEIGHT                          189.9492

LOAD/HANDLING WEIGHT                         170.8413
                          ----------

TOTAL EMPTY WEIGHT                           21960.35

USEFUL LOAD                                  11000

FUEL                                         4000

CREW WEIGHT                                  750

                          ---------

TOTAL GROSS WEIGHT                           37710.35
```

Figure A.1   Section 3.2 Weight Results

```
ROTOR WEIGHT                                        5266.632
TAIL ROTOR WEIGHT                                   398.4973
TAIL STRUCTURE WEIGHT                               284.7139
BODY WEIGHT                                         5616.428
LANDING GEAR WEIGHT                                 1212.537
NACELLE WEIGHT                                      363.8887
ENGINE WEIGHT                                       3963.226
DRIVE TRAIN WEIGHT                                  2825.509
FUEL TANK WEIGHT                                    316.069
FLIGHT CONTROL WEIGHT                               1334.547
AUX POWER WEIGHT                                    139
INSTRUMENT WEIGHT                                   178.1374
HYDRAULICS WEIGHT                                   222.5668
ELECTRICAL WEIGHT                                   638.3101
AVIONICS WEIGHT                                     325
FURNISHINGS WEIGHT                                  424.307
AIRCON/DEICE WEIGHT                                 202.4012
LOAD/HANDLING WEIGHT                                196.7558
                          ----------
TOTAL EMPTY WEIGHT                                  23908.52
USEFUL LOAD                                         11000
FUEL                                                4000
CREW WEIGHT                                         750
                          ---------
TOTAL GROSS WEIGHT                                  39658.52
```

Figure A.2   Section 3.5 Weight Results

```
ROTOR WEIGHT                                      5266.632

TAIL ROTOR WEIGHT                                 414.845

TAIL STRUCTURE WEIGHT                             296.3162

BODY WEIGHT                                       6252.157

LANDING GEAR WEIGHT                               909.2452

NACELLE WEIGHT                                    385.3187

ENGINE WEIGHT                                     4199.272

DRIVE TRAIN WEIGHT                                3002.196

FUEL TANK WEIGHT                                  316.069

FLIGHT CONTROL WEIGHT                             1419.416

AUX POWER WEIGHT                                  139

INSTRUMENT WEIGHT                                 182.4551

HYDRAULICS WEIGHT                                 244.4637

ELECTRICAL WEIGHT                                 669.1964

AVIONICS WEIGHT                                   325

FURNISHINGS WEIGHT                                458.2063

AIRCON/DEICE WEIGHT                               212.7259

LOAD/HANDLING WEIGHT                              220.4214
                               ----------
TOTAL EMPTY WEIGHT                                24912.94

USEFUL LOAD                                       11000

FUEL                                              4000

CREW WEIGHT                                       750

                               ---------

TOTAL GROSS WEIGHT                                40662.94
```

Figure A.3 Section 3.8 Weight Results

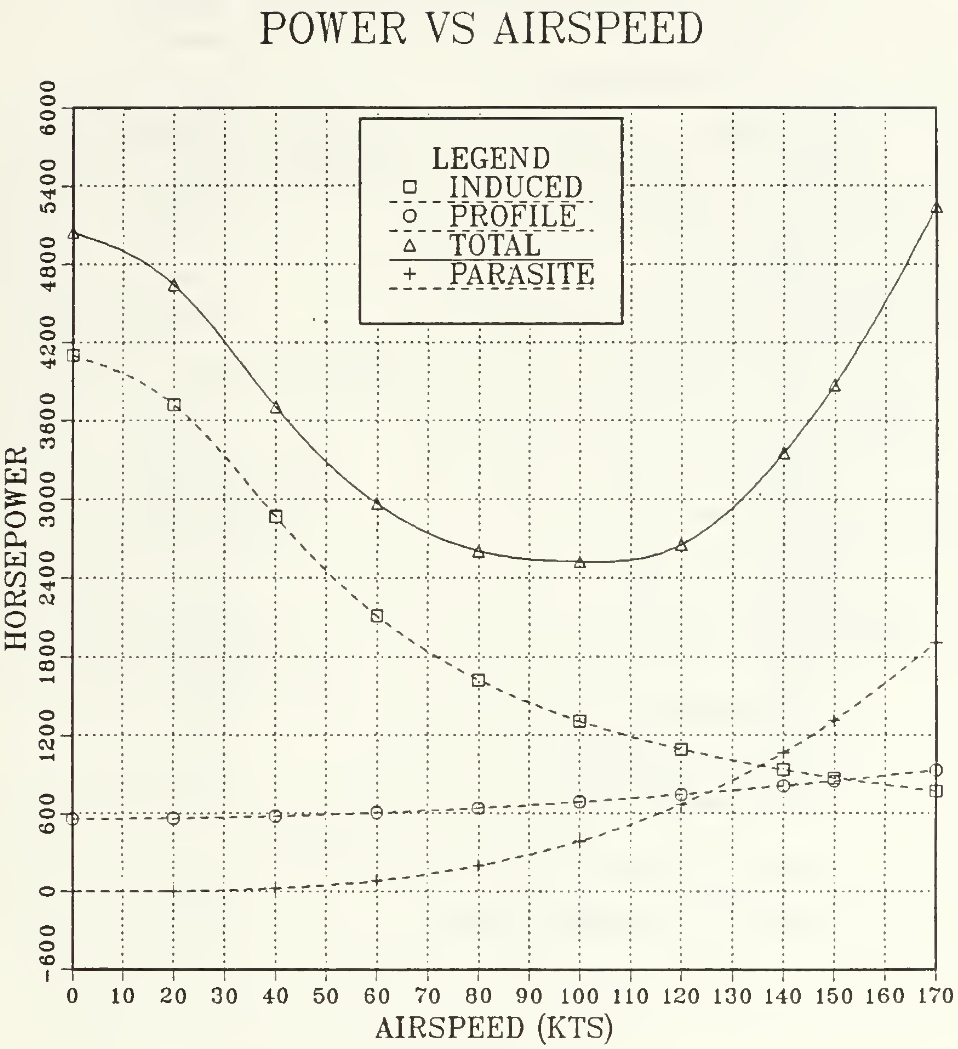

Figure A.4 Power versus Airspeed Plot

```
ROTOR COST                                          365377.6

TAIL ROTOR COST                                     30094.42

TAIL STRUCTURE COST                                 25368.24

BODY COST                                           381532.5

LANDING GEAR COST                                   28372.65

NACELLE COST                                        37292.97

ENGINE COST                                         1400000

DRIVE TRAIN COST                                    197167.8

FUEL TANK COST                                      42051.16

FLIGHT CONTROL COST                                 146566.3

AUX POWER COST                                      22357.39

INSTRUMENT COST                                     15096.15

HYDRAULICS COST                                     14725.01

ELECTRICAL COST                                     63341.69

AVIONICS COST                                       33737.17

FURNISHINGS COST                                    20927.15

AIRCON/DEICE COST                                   29991.62

LOAD/HANDLING COST                                  13451.03
                           ----------
TOTAL COST (1977 US$)                               2867451

TOTAL COST (CURRENT DOLLRS)                         5362134
```

Figure A.5   Component Cost

B. PROGRAM RESULTS

```
             TABLE OF CHAPTER TWO RESULTS


SPECIFICATION GROSS WEIGHT                    42000
ROUGH ESTIMATE GROSS WEIGHT                   33600
ESTIMATE OF MANUFACTURER'S EMPTY WEIGHT       22000
MAXIMUM TIP VELOCITY                          725.9785
ROTOR RADIUS                                  33.94851
ROTATIONAL VELOCITY                           21.38469
THRUST COEFFICIENT                            9.259719E-03
BLADE SOLIDITY                                .1028858
NUMBER OF MAIN ROTOR BLADES                   6
BLADE CHORD                                   1.828836
BLADE ASPECT RATIO                            18.56291
AVERAGE LIFT COEFFICIENT                      .54
BLADE LIFT CURVE SLOPE                        5.73
BLADE DRAG COEFFICIENT                        8.999999E-03
DISC LOADING                                  11.6
MAXIMUM ADVANCE RATIO                         .3487248
MAXIMUM BLADE LOADING                         9.000001E-02
MAXIMUM FORWARD VELOCITY                      150
```

TABLE OF CHAPTER THREE RESULTS

SPECIFICATION GROSS WEIGHT	42000
ROUGH ESTIMATE GROSS WEIGHT	33600
ESTIMATE OF MANUFACTURER'S EMPTY WEIGHT	22000
MAXIMUM TIP VELOCITY	725.9785
ROTOR RADIUS	33.94851
ROTATIONAL VELOCITY	21.38469
THRUST COEFFICIENT	1.110061E-02
BLADE SOLIDITY	.1028858
NUMBER OF MAIN ROTOR BLADES	6
BLADE CHORD	1.828836
BLADE ASPECT RATIO	18.56291
AVERAGE LIFT COEFFICIENT	.54
BLADE LIFT CURVE SLOPE	5.73
BLADE DRAG COEFFICIENT	8.999999E-03
DISC LOADING	11.23072
MAXIMUM ADVANCE RATIO	.3487248
MAXIMUM BLADE LOADING	9.000001E-02
MAXIMUM FORWARD VELOCITY	150
TIPLOSS	.9751666
INDUCED POWER IN HOVER OGE	3675.529
PROFILE POWER IN HOVER OGE	692.979
TOTAL POWER IN HOVER OGE	4368.508
FIGURE OF MERIT	.8225925
PERCENT INDUCED POWER	84.13694
INDUCED POWER IN HOVER IGE	2972.357
TOTAL POWER IN HOVER IGE	3665.336
EQUIVALENT FLAT PLATE AREA	46.33785

```
                              WEIGHT ESTIMATION TABLE

                                                ------------ ITERATION -----------
                                                FIRST          SECOND         THIRD

1.   ROTOR:                                     5266.632       5266.632       5266.632
2.   TAIL  ROTOR:                               377.6182       398.4973       414.845
           STRUCTURE:                           262.8103       284.7139       296.3162
3.   BODY:                                      4920.282       5616.428       6252.158
4.   LANDING GEAR:                              1101.181       1212.537       909.2452
5.   NACELLE:                                   338.2442       363.8887       385.3187
6.   PROPULSION ENGINE:                         3491.852       3963.226       4199.271
                DRIVE:                          2471.216       2825.509       3002.196
                FUEL TANKS:                     316.069        316.069        316.069
7.   FLIGHT CONTROLS:                           1233.494       1334.547       1419.416
8.   AUXILLARY POWER:                           139            139            139
9.   INSTRUMENTS:                               168.6002       178.1374       182.4551
10.  HYDRAULICS:                                197.4284       222.5668       244.4637
11.  ELECTRICAL:                                602.9511       638.3101       669.1965
12.  AVIONICS:                                  325            325            325
13.  FURNISHINGS:                               387.1861       424.307        458.2064
14.  AIR & ICE:                                 189.9492       202.4012       212.7259
15.  LOAD & HANDLING:                           170.8413       196.7558       220.4214




              THE NEW MANUFACTURER'S EMPTY WEIGHT = 24912.94

              THE NEW GROSS WEIGHT = 40662.94
```

MAIN ROTOR POWER

STANDARD SEA LEVEL
ALTITUDE= 0 FT   TEMPERATURE = 59 DEG. F

		POWER			
AIRSPEED (knots)	TIP MACH	INDUCED (SHP)	PROFILE (SHP)	PARASITE (SHP)	TOTAL (SHP)
0.0	0.650	3675.53	692.98	0.00	4368.51
20.0	0.680	3261.74	699.42	3.85	3965.01
40.0	0.710	2395.60	718.75	30.81	3145.15
60.0	0.741	1721.21	750.96	103.98	2576.15
80.0	0.771	1312.32	796.05	246.47	2354.85
100.0	0.801	1054.90	854.03	481.40	2390.32
120.0	0.831	880.62	924.90	831.85	2637.37
140.0	0.862	755.39	1008.65	1320.95	3084.99
150.0	0.877	705.18	1055.35	1624.71	3385.25

MAIN ROTOR POWER

SPECIFICATION ALTITUDE
ALTITUDE = 4000 FT   TEMPERATURE = 95 DEG. F

		POWER			
AIRSPEED (knots)	TIP MACH	INDUCED (SHP)	PROFILE (SHP)	PARASITE (SHP)	TOTAL (SHP)
0.0	0.629	4100.52	559.66	0.00	4660.18
20.0	0.658	3722.30	564.86	3.11	4290.27
40.0	0.688	2866.26	580.47	24.88	3471.61
60.0	0.717	2111.64	606.48	83.98	2802.10
80.0	0.746	1622.30	642.90	199.05	2464.25
100.0	0.775	1307.23	689.72	388.78	2385.73
120.0	0.805	1092.27	746.95	671.81	2511.03
140.0	0.834	937.32	814.59	1066.81	2818.72
150.0	0.848	875.11	852.31	1312.13	3039.55

TABLE OF CHAPTER FOUR RESULTS

TAIL ROTOR RADIUS	8.424962
TAIL ROTOR ROTATIONAL VELOCITY	96.2311
TAIL ROTOR RPM	918.9392
TAIL ROTOR THRUST COEFFICIENT	1.110061E-02
TAIL ROTOR BLADE SOLIDITY	.195883
NUMBER OF TAIL ROTOR BLADES	4
TAIL ROTOR BLADE CHORD	1.296148
TAIL ROTOR BLADE ASPECT RATIO	6.5
TAIL ROTOR BLADE DRAG COEFFICIENT	8.999999E-03
TAIL ROTOR TIPLOSS	.965108
TAIL ROTOR INDUCED POWER IN HOVER OGE	261.5307
TAIL ROTOR PROFILE POWER IN HOVER OGE	113.1711
TAIL ROTOR TOTAL POWER IN HOVER OGE	374.7018
TAIL ROTOR INDUCED POWER IN HOVER IGE	292.0857
TAIL ROTOR TOTAL POWER IN HOVER IGE	383.4836
TAIL LENGTH	41
VERTICAL STABILIZER PLANFORM AREA	44
VERTICAL STABILIZER SPAN	11
VERTICAL STABILIZER SWEEP AT MID-CHORD	47.7
VERTICAL STABILIZER ASPECT RATIO	2.75
VERTICAL STABILIZER ANGLE OF ATTACK	9.832969
VERTICAL STABILIZER COEFFICIENT OF LIFT	.8546744
VERTICAL STABILIZER LIFT CURVE SLOPE	2.649345
LEVER ARM OF VERTICAL STABILIZER	37

TAIL ROTOR POWER WITH VERTICAL STABILIZER

STANDARD SEA LEVEL
ALTITUDE = 0 FT   TEMPERATURE = 59 DEG. F

	----THRUST----		---------------------- POWER -------------------				
AIRSPEED (knots)	TAIL ROTOR (lbf)	VERT/ STAB (lbf)	MAIN ROTOR (SHP)	VERT/ STAB (*SHP*)	INDUCED (SHP)	PROFILE (SHP)	TOTAL with v/s (SHP)
0.0	2740.4	0.0	4368.5	0.0	261.5	113.2	374.7
20.0	2487.3	50.9	3965.0	73.3	188.5	114.0	302.5
40.0	1973.0	203.7	3145.2	293.0	76.8	116.5	193.3
60.0	1616.0	458.3	2576.2	659.3	24.3	120.8	145.1
80.0	1477.2	814.8	2354.8	1172.2	7.0	126.7	133.7
100.0	1499.5	1273.1	2390.3	1831.5	1.2	134.3	135.5
120.0	1654.4	1833.3	2637.4	2637.4	0.0	143.5	143.5
140.0	1935.2	2495.3	3085.0	3589.8	0.7	154.5	155.2
150.0	2123.6	2864.5	3385.2	4120.9	1.4	160.6	162.1

TAIL ROTOR POWER WITH VERTICAL STABILIZER

SPECIFICATION ALTITUDE
ALTITUDE = 4000 FT   TEMPERATURE = 95 DEG. F

	----THRUST----		---------------------- POWER -------------------				
AIRSPEED (knots)	TAIL ROTOR (lbf)	VERT/ STAB (lbf)	MAIN ROTOR (SHP)	VERT/ STAB (*SHP*)	INDUCED (SHP)	PROFILE (SHP)	TOTAL with v/s (SHP)
0.0	2923.3	0.0	4660.2	0.0	292.1	91.4	383.5
20.0	2691.3	48.5	4290.3	69.8	244.3	92.1	336.3
40.0	2177.7	193.9	3471.6	279.0	114.4	94.1	208.5
60.0	1757.8	436.4	2802.1	627.8	38.6	97.5	136.1
80.0	1545.8	775.8	2464.2	1116.0	11.2	102.3	113.5
100.0	1496.6	1212.1	2385.7	1743.8	2.0	108.4	110.5
120.0	1575.2	1745.5	2511.0	2511.0	0.0	115.9	115.9
140.0	1768.2	2375.8	2818.7	3417.8	1.3	124.8	126.1
150.0	1906.7	2727.3	3039.5	3923.5	2.6	129.7	132.3

TAIL ROTOR POWER

STANDARD SEA LEVEL
ALTITUDE = 0 FT   TEMPERATURE = 59 DEG. F

		POWER		
AIRSPEED (knots)	TIP MACH	INDUCED (SHP)	PROFILE (SHP)	TOTAL (SHP)
0.0	0.726	261.53	113.17	374.70
20.0	0.756	200.22	114.01	314.23
40.0	0.786	94.92	116.55	211.47
60.0	0.817	44.84	120.76	165.60
80.0	0.847	28.29	126.67	154.96
100.0	0.877	23.36	134.26	157.62
120.0	0.907	23.74	143.54	167.28
140.0	0.937	27.91	154.51	182.41
150.0	0.953	31.40	160.62	192.03

TAIL ROTOR POWER

SPECIFICATION ALTITUDE
ALTITUDE = 4000 FT   TEMPERATURE = 95 DEG. F

		POWER		
AIRSPEED (knots)	TIP MACH	INDUCED (SHP)	PROFILE (SHP)	TOTAL (SHP)
0.0	0.703	292.09	91.40	383.48
20.0	0.732	259.69	92.08	351.77
40.0	0.761	137.76	94.12	231.89
60.0	0.790	65.41	97.53	162.94
80.0	0.820	38.41	102.30	140.71
100.0	0.849	28.87	108.43	137.30
120.0	0.878	26.70	115.92	142.62
140.0	0.907	28.89	124.78	153.67
150.0	0.922	31.39	129.72	161.11

TABLE OF CHAPTER FIVE RESULTS

BLADE TWIST	-14
BLADE STALL ANGLE OF ATTACK	14
BLADE Mcrit	.775
BLADE LIFT CURVE SLOPE	5.73
BLADE Cdo	8.999999E-03
RSHP REQUIRED AT MAXIMUM VELOCITY:	
SPECIFICATION ALTITUDE	3544.972
STANDARD SEA LEVEL	3577.272
RSHP FOR HOVER CEILING, IGE	7760.253
MAXIMUM RSHP	7760.253
INLETS AND INLET DUCTING LOSSES:	
S-TYPE	0 %
ICE SHEILD	0 %
STRAIGHT IN	2 %
ENGINE AIR PARTICLE SEPARATORS:	
BARRIER	0 %
PARTICLE SEPARATOR	0 %
ENGINE EXHAUST DIFFUSERS:	
HEAT DIFFUSERS	0 %
INFRA-RED SUPPRESSER DIFFUSER	0 %
ENGINE SHAFT HORSEPOWER REQUIRED	8978.214

COMPRESSIBILITY AND STALL EFFECTS ON POWER REQUIRED

STANDARD SEA LEVEL

ALTITUDE = 0 FT   TEMPERATURE = 59 DEG. F

AIRSPEED (kts)	ALPHA (90)	ALPHA (270)	M90	Mcrit	Ps (shp)	Pm (shp)
0.0	-0.190	-0.190	0.6500	0.7826	0.0	0.0
20.0	-0.689	-0.018	0.6802	0.8027	0.0	0.0
40.0	-1.158	0.178	0.7104	0.8215	0.0	0.0
60.0	0.671	6.090	0.7407	0.7480	0.0	0.0
80.0	-0.098	6.899	0.7709	0.7789	0.0	0.0
100.0	-0.717	8.022	0.8011	0.8038	0.0	0.0
120.0	-1.241	9.495	0.8313	0.8248	0.0	0.0
140.0	-1.699	11.400	0.8616	0.8432	0.0	0.0
150.0	-1.909	12.550	0.8767	0.8516	0.0	0.0
170.0	-2.307	15.326	0.9069	0.8676	384.1	0.0

COMPRESSIBILITY AND STALL EFFECTS ON POWER REQUIRED

SPECIFICATION ALTITUDE

ALTITUDE = 4000 FT   TEMPERATURE = 95 DEG. F

AIRSPEED (kts)	ALPHA (90)	ALPHA (270)	M90	Mcrit	Ps (shp)	Pm (shp)
0.0	0.922	0.922	0.6291	0.7380	0.0	0.0
20.0	0.276	1.216	0.6584	0.7639	0.0	0.0
40.0	-0.328	1.550	0.6876	0.7882	0.0	0.0
60.0	1.729	8.492	0.7169	0.7056	0.0	0.0
80.0	0.755	9.459	0.7461	0.7447	0.0	0.0
100.0	-0.039	10.757	0.7754	0.7766	0.0	0.0
120.0	-0.720	12.394	0.8046	0.8039	0.0	0.0
140.0	-1.324	14.426	0.8339	0.8281	86.8	0.0
150.0	-1.603	15.616	0.8485	0.8394	344.3	0.0
170.0	-2.128	18.403	0.8777	0.8604	1029.8	0.0

TOTAL POWER REQUIRED
(With High Speed Effects)
STANDARD SEA LEVEL
ALTITUDE = 0 FT   TEMPERATURE = 59 DEG. F

AIRSPEED (kts)	Pi (shp)	Po (shp)	Pp (shp)	Ps (shp)	Pm (shp)	Ptr (shp)	PT (shp)
0.0	3675.5	693.0	0.0	0.0	0.0	374.7	4743.2
20.0	3261.7	699.4	3.9	0.0	0.0	314.2	4279.2
40.0	2395.6	718.7	30.8	0.0	0.0	211.5	3356.6
60.0	1721.2	751.0	104.0	0.0	0.0	165.6	2741.8
80.0	1312.3	796.1	246.5	0.0	0.0	155.0	2509.8
100.0	1054.9	854.0	481.4	0.0	0.0	157.6	2547.9
120.0	880.6	924.9	831.9	0.0	0.0	167.3	2804.7
140.0	755.4	1008.6	1320.9	0.0	0.0	182.4	3267.4
150.0	705.2	1055.4	1624.7	0.0	0.0	192.0	3577.3
170.0	622.4	1158.4	2365.1	384.1	0.0	215.8	4745.8

TOTAL POWER REQUIRED
(With High Speed Effects)
SPECIFICATION ALTITUDE
ALTITUDE = 4000 FT   TEMPERATURE = 95 DEG. F

AIRSPEED (kts)	Pi (shp)	Po (shp)	Pp (shp)	Ps (shp)	Pm (shp)	Ptr (shp)	PT (shp)
0.0	4100.5	559.7	0.0	0.0	0.0	383.5	5043.7
20.0	3722.3	564.9	3.1	0.0	0.0	351.8	4642.0
40.0	2866.3	580.5	24.9	0.0	0.0	231.9	3703.5
60.0	2111.6	606.5	84.0	0.0	0.0	162.9	2965.0
80.0	1622.3	642.9	199.1	0.0	0.0	140.7	2605.0
100.0	1307.2	689.7	388.8	0.0	0.0	137.3	2523.0
120.0	1092.3	747.0	671.8	0.0	0.0	142.6	2653.7
140.0	937.3	814.6	1066.8	86.8	0.0	153.7	3059.2
150.0	875.1	852.3	1312.1	344.3	0.0	161.1	3545.0
170.0	772.5	935.6	1910.1	1029.8	0.0	180.0	4827.9

TABLE OF CHAPTER SIX RESULTS

SELECTED ENGINE DATA	
DRY WEIGHT	720
SHP	4380
SFC	.466
INITIAL COST	700
OPERATING COST	60
PREVENTIVE MAINTENANCE	220
MTBMA	3.5
MDT	2.6
MTBR	750
REPLACEMENT COST	945
SALVAGE COST	560
AVAILABILITY	.5737705
RELIABILITY	.9978148
MAINTAINABILITY	.2983607
TRANSMISSION RATING (SHP)	8500
TRANSMISSION WEIGHT	5000
NEW GROSS WEIGHT	40247.07
TOTAL POWER TO HOVER OGE	4681.426
DISC LOADING	11.11586
FIGURE OF MERIT	.8206506
PERCENT INDUCED POWER	83.9285
PERCENT DIFFERENCE IN POWER	1.319888
PERCENT DIFFERENCE IN WEIGHT	1.033295

ENGINE SELECTION CRITERIA

	ENGINE				
	A	B	C	D	E
POWERPLANT WEIGHT:	893	930			
LIFE-CYCLE COST (1000s):	3545	3545			
ENGINE LIFE (hrs):	750	750			
No. OF REPLACEMENTS:	2	2			
R/D COSTS:	0	0			
INITIAL COSTS:	700	700			
ANNUAL MAINT. COST:	26	26			
ANNUAL OPERATING COST:	7	7			
REPLACEMENT COST:	945	945			
SALVAGE VALUE:	560	560			
AVAILABILITY (per engine):	0.5738	0.5738			
RELIABILITY (per engine):	0.9978	0.9978			
MAINTAINABILITY (per engine):	0.2984	0.2984			
PERFORMANCE (military SHP):	4380	3400			

TABLE OF CHAPTER SEVEN RESULTS

SFC MILITARY POWER	.466
SFC NORMAL POWER	.471
SFC CRUISE POWER	0
SHP MILITARY POWER	4380
SHP NORMAL POWER	3700
SHP CRUISE POWER	0
FUEL FLOW MILITARY POWER	4082.16
FUEL FLOW NORMAL POWER	3485.4
FUEL FLOW CRUISE POWER	0
ZERO HORSEPOWER INTERCEPT AT SSL	238.3233
ZERO HORSEPOWER INTERCEPT AT SPEC. ALTITUDE	212.8536
PHANTOM HORSEPOWER AT SSL	543.1323
PHANTOM HORSEPOWER AT SPEC. ALTITUDE	485.0875
MAXIMUM RANGE VELOCITY	138
MAXIMUM RANGE REFFERED HORSEPOWER	3767.032
MAXIMUM RANGE FUEL FLOW	1652.951
MAXIMUM ENDURANCE VELOCITY	87
MAXIMUM ENDURANCE REFFERED HORSEPOWER	3045.48
MAXIMUM ENDURANCE FUEL FLOW	1336.339
CRUISE FUEL FLOW AT SSL	1677.498
CRUISE FUEL FLOW AT SPEC. ALTITUDE	1559.997
TOTAL FUEL REQUIRED	4714.016
NEW GROSS WEIGHT	40961.09

TABLE OF CHAPTER EIGHT RESULTS

HOVER POWER FOR DESIGN GROSS WEIGHT	4803.413
PERCENT DIFFERENCE IN DESIGN GROSS WEIGHT	.7278821
DIFFERENCE IN DESIGN AND SPEC. GROSS WEIGHT	1038.91
NEW GROSS WEIGHT	40961.09
MAXIMUM RATE OF CLIMB AIRSPEED	87
MAXIMUM RATE OF CLIMB	6259.86
MAXIMUM RATE OF CLIMB POWER REQUIRED	2509.604
MAXIMUM HOVER ALTITUDE, IGE	9140
SERVICE CEILING	16410
BODY WIDTH	8.899999
BODY HEIGHT	8.899999
FUSELAGE LENGTH	54.94

```
                                FINAL SUMMARY

                               * PERFORMANCE *

                                          SPECIFICATION           DESIGN
CREW:                                         3                    3
INTERNAL LOAD (lbs):                          11000                11000
SERVICE CEILING (ft):                         20000                16410
HOVER CEILING (ft):                           15250                9140
VELOCITY (kts) CRUISE:                        140                  140
               MAXIMUM:                       150                  150
               MAX ENDURANCE:                                      87
               MAX RANGE:                                          138
               BLADE STALL ON-SET:                                 140
MAX RATE OF CLIMB (FT/MIN):                   1750                 6259.86
ENGINE -       NUMBER:                                             2
               TYPE:                                              T64-GE-415/416
               SHP (ssl) MILITARY:                                 4380

                                * GEOMETRY *

WEIGHT (lbs)   MAX GROSS:                     42000                40961.09
               EMPTY:                                              24497.07
FUEL CAPACITY (lbs):                                               4714.016
MAIN ROTOR -   CHORD (ft):                                         1.828836
               RADIUS (ft):                   34                   33.94851
               NUMBER OF BLADES:                                   6
               DRAG COEFFICIENT:                                   8.999999E-03
               SOLIDITY:                                           .1028858
TAIL ROTOR -   CHORD (ft):                                         1.296148
               RADIUS (ft):                                        8.424962
               NUMBER OF BLADES:                                   4
               DRAG COEFFICIENT:                                   8.999999E-03
               ROTATIONAL VEL (rad/sec):                           96.2311
               SOLIDITY:                                           .195883
               VERTICAL TAIL AREA (ft2):                           44
FUSELAGE LENGTH (ft):                         55                   54.94
EFPA (ft2) -   FORWARD:                                            46.33785
               VERTICAL:                                           88.88743
```

```
                              COST ESTIMATION TABLE

                                                          COST

1.   ROTOR:                                               365377.7
2.   TAIL  ROTOR:                                         30094.42
           STRUCTURE:                                     25368.24
3.   BODY:                                                381532.5
4.   LANDING GEAR:                                        28372.65
5.   NACELLE:                                             37292.97
6.   PROPULSION ENGINE:                                   1400000
                DRIVE:                                    197167.8
                FUEL  TANKS:                              42051.16
7.   FLIGHT CONTROLS:                                     146566.4
8.   AUXILLARY POWER:                                     22357.39
9.   INSTRUMENTS:                                         15096.15
10.  HYDRAULICS:                                          14725.02
11.  ELECTRICAL:                                          63341.7
12.  AVIONICS:                                            33737.17
13.  FURNISHINGS:                                         20927.16
14.  AIR & ICE:                                           29991.63
15.  LOAD & HANDLING:                                     13451.02
                              TOTAL COST = 5362134
```

APPENDIX B

HELICOPTER DESIGN PROGRAM USER'S GUIDE

I. INTRODUCTION

This program is not intended to eliminate the requirement for the *Helicopter Design Manual* by Professor Donald M. Layton [Ref. 1] but to complement it. The program follows Reference 1 section by section thus requiring its availability as a reference during design development. The program itself is menu driven allowing selection of chapters, sections and options by using the cursor keys and the enter key (↵). Chapters Two through Ten of Reference 1 are covered by the program. The program's Chapter One is an introduction to program use.

II. THE BASICS

A. HARDWARE REQUIREMENTS

An IBM PC or compatible computer with at least 128K RAM will be needed. A color monitor is preferable but not a must; however, a color or monochrome graphics card should be installed. Any type of printer that allows print screen operation will work.

B. GETTING STARTED

Place the main program disk into Drive A and a formatted disk (see the computer's operation manual for formatting instructions) into Drive B, this will be your data disk. The program is bootable from the disk so just turn the computer on and the program will load and start running. If the computer is already on, load the disks as stated above, hit the CTRL,ALT,DELETE keys simultaneously and the program will load and run.

C. RUNNING THE PROGRAM

After program loading is complete the main menu will appear on the screen. The cursor bar will be over the first selection of the menu which is Chapter One. If a first time user, take a minute to look over the introductory chapter, otherwise select the chapter or option desired. Chapter or option selection may be made by moving the cursor bar over the selection with the up (↑) or down (↓) cursor key and depressing the enter (↵) key. A loading chapter... please wait... window will appear followed by the menu for the selected chapter. Section or option selection can be made the same way as with the main menu.

1. Some Special Notes

a. Press Any Key to Continue

When a "press any key to continue" is displayed, do not use the space-bar. If by chance the space-bar is used, just press it again and then press another key.

b. Clearing Data in the Program

If at any time data or variable assignments need to be cleared from the program and reloaded from the file disk (this is a good idea when redoing a chapter to prevent mixing old and new data), return to the main menu and hit the F5 key and then the enter (↵) key. Now reload the desired data from the file disk.

D. OPTIONS

1. Do all of the Sections in Order

All of the sections of the chapter may be done in order without returning to the chapter menu between each section by selecting this option. If the need to return to the chapter menu arises, press the F9 key and then the enter (↵) key and the chapter menu will appear.

2. Input Data

If data for a chapter has been generated outside of the program it may be entered into the program using this option (for Chapters Two through Four). If data is input for a section, that section of the program should not be done because the program generated data will override the input data.

3. List Results

This option displays the data generated for that particular chapter on the screen.

4. Hard Copy of Results

If a print out of the chapter results is needed, use this option. Make sure the printer is on.

5. Store Data on File Disk

It is a good idea after completion of a chapter to store the data generated by the program. Selecting this option will display a saving data... please wait... window followed by the chapter menu ready for the next selection. Data can be stored for Chapters Two through Eight.

6. Return to Main Menu

This option returns the program to the main menu to continue to the next chapter or terminate the program.

7. Load Data From File Disk

This option is for accessing data stored on the data disk. The last chapter from which data was stored will be displayed as a reminder. Enter the chapter number of the data to be loaded. A loading data... please wait... window will appear followed by the main menu waiting for the next selection.

8. Exit the Program

To return to DOS select this option.

E. CHAPTER SPECIAL INSTRUCTIONS

1. Chapter One

This is a brief introduction to program operation.

2. Chapter Two

Chapter Two covers the main rotor design. This closely follows the design manual.

3. Chapter Three

Preliminary power calculations are developed in this chapter.

a. Section 3.4

The screen will display the required data for this section in the top left box. The lower left box displays parameter trends (these are not the final results) to aid in the decision making process to get figure of merit and percent induced power within limits. A maximum of ten iterations may be done in this section.

b. Section 3.8

If while doing this section, the program keeps returning to section 3.3 or section 3.4 consider interrupting by pressing the F9 key, then the enter key (↵) and double checking the parameters causing the break in execution. This may even require returning to chapter two to make changes.

4. Chapter Four

The tail rotor design is performed in this chapter.

a. Section 4.4

Prior to doing this section a vertical stabilizer design should be completed. The program will need the span and planform area of the vertical stabilizer. The equivalent flat plate area and parasite power are for information only and not included in the total power calculations. Also the tail rotor power with vertical stabilizer power calculations are for information only and not included in the following power calculations.

5. Chapter Five

Chapter Five deals with power refinements.

a. Section 5.1

This section is not part of the design manual. This routine provides the power required at maximum forward velocity for up to five different rotor blades at varied twist angles. The program allows for selection of the rotor blade requiring the least amount of power for the particular design. The blade, it's characteristics and twist angle associated with the minimum power requirement should be used in the remainder of the chapter. When putting blade data into the table put the required data under the appropriate heading and press the enter key (↵), the cursor will automatically move to the next entry point.

b. Sections 5.12 - 5.14

After each selection is made a "*" will appear after each selection as a reminder which devices have been selected.

6. Chapter Six

No special instructions for this chapter.

7. Chapter Seven

Range and endurance calculations are made in this chapter.

a. Section 7.1

If the selected engine's data is taken from another source the military and normal powers and SFC maybe the only specifications given. Enter these and enter zero for the cruise entries.

b. Section 7.5

This section will take some time to compute. The machine will beep when complete.

8. Chapter Eight

This chapter is for several miscellaneous calculations.

a. Section 8.1

Enter the weight combination (i.e., gross weight, fuel and useful load) that will best meet specification requirements.

b. Sections 8.2 - 8.4

These sections will take some time to compute. The machine will beep when complete.

9. Chapters Nine and Ten

The data for these chapters is not stored on the file disk. Chapter Eight data is required to complete these two chapters.

10. Units

All units will be the same as addressed in Reference 1 and Reference 2. Some examples are:

Airspeed - knots
Altitude - feet
Angle - degrees
Weight - pounds
Rotational velocity - radians per second
Power - horsepower
Fuel flow - pounds per hour
Temperature - degrees Fahrenheit

APPENDIX C

VARIABLE DEFINITIONS AND PROGRAM LISTING

A. VARIABLE DEFINITIONS

1. Constants

PI = 3.1415927
RHO = sea level density
M(1) = mach number at seal level

2. Counters and Indices

X = chapter or section
Z = chapter counter for saving data
N = number of weight iterations
Y = weight category (chapter 3)
E = index for weight and power variables in section 3.4
W = option item for section 3.4
EE = counter for section 3.4
I,J,K,KK,L,D = for loop indices
NN = counter in section 3.4
LL = counter for airspeed 20 kt. increments
RE = screen listing option
V,Q = data storage counters
LLL = airspeed counter in chapter 5
PR = print option selection
U = selection for engine duct type
K1 = counter for line spacing in engine installation display
JJ = counter for maximum range calculations
Gxx = counter for data storage and data loading

3. Flags

AP = eliminate "press any key to continue" for chapter two or printer flag for chapter three to print tables.
AB = list weight estimation table on screen or display results from section 3.8
A5 = display weight table results for section 3.5
X7 = return to section 3.8 from section 3.3

ZZ,ZA = determine which specific groups of equations needed to recalculate figure of merit in section 3.4
AA = determines landing gear type for weight calculations
AZ = for returning to section 3.8 from 3.4
AQ = return to chapter four menu from section 4.3
AU = printer flag for chapter five
X1 = return to section 5.7 from 5.4 or 5.5
AV = printer flag for chapter six
AX = printer flag for chapter nine

4. Chatper Two Variables

SGW = specification gross weight
GW1 = rough estimate gross weight
WE = estimate of manufacturer's empty weight
VTIPMAX = maximum tip velocity
R = rotor radius
OMEGA = rotational velocity
CT = thrust coefficient
SIGMA = blade solidity
B = number of blades
C = main rotor blade chord
AR = main rotor blade aspect ratio
CL = average lift coefficient
CLALPHA = blade lift curve slope
CDO = blade drag coefficient
DL = disk loading
MU = maximum advance ratio
MBL = Maximum blade loading
MAXFVEL = maximum forward velocity

5. Chapter Three Variables

TIPLOSS = main rotor blade tiploss
PIN = induced power in hover OGE
PO = profile power in hover OGE
PT = total power in hover OGE
FM = figure of merit
PERINDP = percent induced power
PERDIFW = percent difference in weight
PERDIFP = percent difference in power
PINI = induced power in hover IGE
PTI = total power in hover IGE
EFPA = equivalent flat plate area
HP = total power in hover OGE
PEOPLE = number of people
PAX = weight of people
SPECIAL = weight of special equipment

S = total main rotor blade planform area
W(x,x) = component weight
UL = useful load
FUEL = fuel weight
NW = number of landing gear
GR = type of landing gear
RH = main rotor height above the ground
H = main rotor height above ground at HIGE
M = mission type of helicopter
ALT = specification altitude
O(x) = J = airspeed in twenty knot increments
VF = VF1 = airspeed in feet per second
CRUISEV = CRU = cruise velocity
PIF(x,x) = induced power in forward flight
POF(x,x) = profile power in forward flight
PPF(x,x) = parasite power in forward flight
PTF(x,x) = total power in forward flight
TM(x,x) = main rotor tip mach number
MU = MU1 = maximum advance ratio
STT = tail surface area
SB = body surface area
ENGINE = number of engines

6. Chapter Four Variables

TR = tail rotor radius
TCDO = tail rotor drag coefficient
TRPM = tail rotor RPM
TAR = tail rotor aspect ratio
TRC = tail rotor chord
OMEGAT = tail rotor rotational velocity
SIGMAT = tail rotor solidity
TL = tail length
TRA = tail rotor area
TRVT = VTTR = tail rotor tip velocity
TTR = tail rotor thrust
CTTR = tail rotor thrust coefficient
PITR = tail rotor induced power
POTR = tail rotor profile power
VF = VF1 = airspeed in feet per second
PITRF(x,x) = tail rotor induced power in forward flight
POTRF(x,x) = tail rotor profile power in forward flight
VITR = tail rotor induced velocity
SWP = vertical stabilizer sweep angle in degrees
SWEEP = vertical stabilizer sweep angle in radians
LAVS = lever arm for vertical stabilizer
V = O(x) = airspeed in knots
CLATR = vertical stabilizer lift curve slope

TEFPA = vertical stabilizer equivalent flat plate area
TPP = added parasite power due to vertical stabilizer
ALTR = vertical stabilizer angle of attack in radians
ALTRDEG = vertical stabilizer angle of attack in degrees
VSAR = vertical stabilizer aspect ratio
SPAN = vertical stabilizer span
S = vertical stabilizer planform area
VERSTAB = equivalent power of vertical stabilizer
VITR1 = tail rotor induced power with vertical stabilizer
TRT = tail rotor thrust with vertical stabilizer
PITRFI(x,x) = tail rotor induced power with vertical stabilizer in forward flight
PTTRVSF(x,x) = tail rotor total power with vertical stabilizer in forward flight
TTM(x,x) = tail rotor blade tip mach number

7. Chapter Five Variables

BLTW = main rotor twist angle in degrees
THT = main rotor twist angle in radians
AMAX = stall angle of attack for main rotor blades in degrees
AM = stall angle of attack for main rotor blades in radians
DA = disk area
VT = main rotor tip velocity
O(x) = airspeed in knots
MU3 = maximum advance ratio
AL90(x,x) = blade angle of attack at 90 degree position
AL270(x,x) = blade angle of attack at 270 degree position
MTIP = main rotor blade tip mach number
M90(x,x) = main rotor blade mach number at 90 degree position
MCRIT(x,x) = main rotor blade critical mach number
MD = main rotor blade critical mach number for drag divergence
ALT1 = specification hover ceiling
CTHC = thrust coefficient at hover ceiling
TIPHC = tiploss at hover ceiling
PIHC = main rotor induced power at hover ceiling

POHC = main rotor profile power at hover ceiling
PINIGEH = induced power to HIGE at hover ceiling
PTTI = total power to HIGE at hover ceiling
TRTH = tail rotor thrust at hover ceiling
CTTRHC = tail rotor thrust coefficient at hover ceiling
TIPTRHC = tail rotor tiploss at hover ceiling
DELTA = pressure ratio
THETA = temperature ratio
PITRHC = tail rotor induced power at hover ceiling
POTRHC = tail rotor profile power at hover ceiling
PTTRHC = tail rotor total power at hover ceiling
RSHP = maximum rotor shaft horsepower
STYPE = s-type inlet
ICESHD = ice shield inlet
STRTIN = straight in inlet
INLET = total inlet losses
PINLET = percent loss due to inlets
RSHP1 = added horsepower for inlets
RSHP1A = total horsepower required with inlets
PS = percent loss due to partical separator
BARR = barrier filter
PARTSEP = partical separator
EAPS = total losses due to engine air partical separators
PEAPS = percent loss due to eaps
RSHP2 = added horsepower for eaps
RSHP2A = total power required with eaps
HDIF = heat diffusers
INRED = infra-red suppresser
EEDS = total losses due to engine exhaust diffusers
PEEDS = percent loss due to eeds
RSHP3 = added horsepower for eeds
RSHP3A = total power required with eeds
LOSS = losses for one engine
LOSSA = losses for two engines
LOSSB = losses for three engines
ESHP = engine shaft horsepower

8. Chapter Six Variables

ENG = number of engines competing for selection
MDT = maintenance down time
MTBF = mean time between failure
MTBR = mean time between replacement
DW(x) = engine dry weight
SHP(x) = engine shaft horsepower at military
SFC(x) = specific fuel consumption at military

IC(x) = initial cost
OC(x) = operating cost per hour
PMA(x) = preventative maintenance per engine per hour
MTBMA(x) = mean time between maintenance action
AFL = average flight hours per year
SL = aircraft service life
TAV = average flight hour per flight
YM(x) = engine yearly maintenance cost
YO(x) = engine yearly operating cost
NRPL(x) = number of engine replacements
LC(x) = engine life-cycle cost
RD(x) = engine research and development costs
AVAIL(x) = engine availability
MAINT(x) = engine maintainability
RELY(x) = engine reliability
RC(x) = replacement costs
SV(x) = salvage costs
EWT(x) = installation weight
TRWT = transmission weight
TRPWR = transmission power rating
NCT,NPIN,NPO, etc. = N means new values of these variables

9. Chapter Seven Variables

SFC(x) = specific fuel consumption
SHP(x) = shaft horsepower
WDOTF(x) = fuel flow in pounds per hour
BETAH = slope of the fuel flow versus horsepower curve
ALPHAH = zero horsepower intercept
DELTA = pressure ratio
THETA = temperature ratio
TEMP = specification temperature
PHANTOM(x) = phantom horsepower
MRV = maximum range velocity
FFR = maximum range fuel flow
MRP = maximum range referred horsepower
MRP1 = maximum range horsepower
MEV = VMIN = maximum endurance velocity
PMIN = SHP for maximum endurance
ERSHPR = maximum endurance referred horsepower
EFFR = maximum endurance fuel flow
CRUISEV = cruise velocity
CRUPWR = cruise power
CRUFFR(X) = cruise fuel flow
MAXRG = specification maximum range
TFUEL = total fuel required
NGW2 = new gross weight with required fuel

10. Chapter Eight Variables

PDGW = percent difference between specification and design gross weight
EW1 = empty weight as of chapter five
EW2 = empty weight as of chapter seven
PTF1 = hover power for design gross weight
PDGW2 = percent difference in design gross weight
DIF = difference between specification and design gross weight
LC = useful load plus DIF
FW = total fuel weight plus DIF
NRANGE = range with FW fuel weight
NGW3 = new selected gross weight
T2FUEL = new selected fuel weight
MCSHP = MCS = maximum rate of climb horsepower
MCV = maximum rate of climb airspeed
VVERT = maximum rate of climb in feet per minute
LS = power available at sea level with partial installation losses
PTASL = total power available at sea level with all losses
D = rotor diameter
H = rotor height above the ground at HIGE
PA = power available at altitude
PR(x) = power required at altitude
THETA = temperature ratio
DELTA = pressure ratio
AL(x) = altitude in feet for section 8.3
MHA = maximum hover altitude
ALA(x) = altitude in feet for section 8.4
VEFPA = vertical equivalent flat plate area
SC = service ceiling
BW = body width
BH = body height

11. Chapter Nine Variables

All variables are the same as above.

12. Chapter Ten Variables

C(X) = component cost
CE(x) = total cost
IFR = inflation rate
Q = quantity to be produced

B. MAIN PROGRAM

```
1 '********************************************************

                      MAIN PROGRAM

5 '********************************************************
10 G=0:ZZ=0:Z=0
20 IF CH3=3 THEN DIM A(1100):CH3=0
30 IF DIM1=1 THEN GOTO 540 ELSE
40  KEY OFF
50  SCREEN 1,0
60  COLOR 8,1
70  FOR I = 1 TO 2
80  IF I = 1 THEN FILL = 11 ELSE FILL = 12
90  IF I = 1 THEN EDGE = 9 ELSE EDGE = 10
100  IF I = 1 THEN X1=104: X2=82 ELSE X1=106: X2=84
110  IF I = 1 THEN Y1=86: Y2=132 ELSE Y1=84: Y2=130
120  ' "H"
130  DRAW "C=EDGE;BM=X1;,=Y1;U30R4D12R12U12R4D30L4U12"
140  DRAW "L12D12L4BE1P=FILL;,=EDGE;"
150  ' "E"
160  X1= X1 + 26
170  DRAW "C=EDGE;BM=X1;,=Y1;U30R20D4L16D9R8D4L8D9R16D4L20
BE1P=FILL;,=EDGE;"
180  ' "L"
190  X1= X1 + 26
200  DRAW "C=EDGE;BM=X1;,=Y1;U30R4D26R16D4L20BE1P=FILL;,=
EDGE;"
210  ' "O"
220  X1= X1 + 26
230  DRAW "C=EDGE;BM=X1;,=Y1;U30R20D30L20BR4BU4U22R12D22L1
2BG1P=FILL;,=EDGE;"
240  'NEXT LINE
250  ' "D"
260  DRAW "C=EDGE;BM=X2;,=Y2;U30R16f5D20g5L16BR4BU4U22R12D
22L12BG1P=FILL;,=EDGE;"
270  ' "E"
280  X2= X2 + 26
290  DRAW "C=EDGE;BM=X2;,=Y2;U30R20D4L16D9R8D4L8D9R16D4L
20BE1P=FILL;,=EDGE;"
300  ' "S"
310  X2= X2 + 26
320  DRAW "C=EDGE;BM=X2;,=Y2;BU1U2E2R16H19U4E2R20F2D2G2"
330  DRAW "L16F19D4G2L20H2BR2BU1P=FILL;,=EDGE;"
340  ' "I"
350  X2= X2 + 30
360  DRAW "C=EDGE;BM=X2;,=Y2;U30R4D30L4BE1P=FILL;,=EDGE;"
```

```
370  ' "G"380  X2= X2 + 14
390  DRAW "C=EDGE;BM=X2;,=Y2;U30R20D4L16D22R12U4L4U4R8"
400  DRAW "D12L20BE1P=FILL;,=EDGE;"
410  ' "N"
420  X2= X2 + 26
430  DRAW "C=EDGE;BM=X2;,=Y2;U30R4F12U12R4D30L4H12D12L
4BE1P=FILL;,=EDGE;"
440 NEXT I
450 FOR I=1 TO 2000:NEXT I:G=1+G
460 COLOR 4,1:IF G=1 THEN GOTO 70 ELSE IF G=2 THEN COLOR
1,1:GOTO 70 ELSE GOTO 480
470 CLEAR,,1500
480 SCREEN 2:SCREEN 0,1:COLOR 15,1
490 DIM A(1100),W(15,20),GW(20),WE(20),PINF(2,60),POF(2,60
),PPF(2,60),PTF(2,60),TM(2,20),O(20),W2A(20),W2B(20),W6A(2
0),W6B(20),W6C(20),PT(20),FM(20),DL(20),AL90(2,60),AL270(2
,60),PITRF(2,60),POTRF(2,60),PTTRF(2,60),VERSTAB(2,60),PTT
RVSF(2,20),PITRF1(2,20)
500 DIM PTT(2,60),TTM(2,20),TRT(2,20),L(2,20),M90(2,60),MC
RIT(2,60),PS(2,60),PM(2,60),RHO(60),PINF1(60),POF1(60),PTF
1(60),PITR1(60),POTR1(60),PTTR1(60),PR(60),PPF1(60),PITRF2
(60),POTRF2(60),PTTRF1(60),PS1(60),PM1(60),M901(60),MCRIT1
(60)
510 DIM PITRFI(2,20),AL901(60),AL2701(60),PTT1(60),ALA(60)
,C(20),CE(20),PTF5(2,20),ANG(200),AL(60),SAVEP(21),SAVEV(2
1),RSHP(5,20),POFA(2,20),PPFA(2,20),PTFA(2,20),PITRFA(2,20
),POTRFA(2,20),PTTRFA(2,20),SAVEPS(21),SAVEPM(21)
520 OPTION BASE 0
530 DIM1=1
540 '                   DEFINE CONSTANTS
550 '
560 PI = 3.1415927#
570 RHO = 2.37691E-03
580 M(1) = 1116.89
590 LOCATE 1,1,0
600 '
610 '
620 '
630 '               ******  MAIN MENU  ******
640 KEY(5) ON
650 ON KEY(5) GOSUB 670
660 GOTO 680
670 CLEAR,,1500:GOTO 490
680 '
690 CLS:PRINT "~C=ALL/":PRINT "~L=HELO/"
700 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=MAINMENU/":LOCATE ,,0:INPUT;"",Y1:CLS:COLOR 15,1,1:IF
Y1=11 THEN GOSUB 740 ELSE IF Y1=12 GOTO 1860
710 CLS:PRINT "~W=LOADNOTE/":GOTO 720
720 IF Y1=1 THEN CHAIN "CHAP1",,ALL ELSE IF Y1=2 THEN
CHAIN "CHAP2",,ALL ELSE IF Y1=3 THEN CHAIN "CHAP3",,ALL
```

```
ELSE IF Y1=4 THEN CHAIN "CHAP4",,ALL ELSE IF Y1=5 THEN
CHAIN "CHAP5",,ALL ELSE
730 IF Y1=6 THEN CHAIN "CHAP6",,ALL ELSE IF Y1=7 THEN
CHAIN "CHAP7",,ALL ELSE IF Y1=8 THEN CHAIN "CHAP8",,ALL
ELSE IF Y1=9 THEN CHAIN "CHAP9",,ALL ELSE IF Y1=10 THEN
CHAIN "CHAP10",,ALL
740 '
750 '
760 '     ******  DATA INPUT FROM FILE DISK  ******
770 '
780 '
790 CLS:LOCATE 23,1,0:PRINT "~W=DISK/":GOSUB 1030:LOCATE
25,27,0:PRINT "                                 ":OPEN
"B:DATA1" FOR INPUT AS #1:INPUT #1, Z:FOR I=1 TO 10:INPUT
#1, LL(I):NEXT I:CLOSE #1
800 LOCATE 14,20,1:PRINT "THE LAST CHAPTER DATA ENTERED
IS:";Z:LOCATE 16,20,1:INPUT "WHICH CHAPTER DATA DO YOU
WANT ENTERED";ZB:PRINT "~C=ALL/":PRINT "~W=LOADDATA/":IF
ZB=2 THEN GOTO 820 ELSE
810 IF ZB=3 GOTO 840 ELSE IF ZB=4 GOTO 900 ELSE IF ZB=5
GOTO 1070 ELSE IF ZB=6 GOTO 1220 ELSE IF ZB=7 THEN GOTO
1420 ELSE IF ZB=8 GOTO 1640
820 OPEN "B:DATA2" FOR INPUT AS #1:FOR I=1 TO 18:INPUT #1,
A(I):NEXT I:CLOSE #1
830 SGW=A(1):GW1=A(2):WE=A(3):VTIPMAX=A(4):R=A(5):OMEGA=
A(6):CT=A(7):SIGMA=A(8):B=A(9):C=A(10):AR=A(11):CL=A(12):C
LALPHA=A(13):CDO=A(14):DL=A(15):MBL=A(16):MU=A(17):MAXFVEL
=A(18):RETURN 700
840 OPEN "B:DATA3" FOR INPUT AS #1:FOR I=1 TO LL(1):INPUT
#1, A(I):NEXT I:CLOSE #1
850 SGW=A(1):GW1=A(2):WE=A(3):VTIPMAX=A(4):R=A(5):OMEGA=
A(6):CT=A(7):SIGMA=A(8):B=A(9):C=A(10):AR=A(11):CL=A(12):C
LALPHA=A(13):CDO=A(14):DL=A(15):MBL=A(16):MU=A(17):MAXFVEL
=A(18):TIPLOSS=A(19):PIN=A(20):PO=A(21):PT=A(22):HP=A(23):
PERINDP=A(24)
860 V=24:FOR I=1 TO 3:FOR J=1 TO 15:V=V+1:Q=J+24:W((Q-
24),I)=A(V):NEXT J,I:FOR I=1 TO
3:W2A(I)=A(I+69):W2B(I)=A(I+72):W6A(I)=A(I+75):W6B(I)=A(I+
78):W6C(I)=A(I+81):NEXT
I:N=A(85):WE(N)=A(86):GW(N)=A(87):DL(N-1)=A(88):FM(N-
1)=A(89):FL=A(90):IRLG=A(91)
870 NW=A(92):PERDIFW=A(93):PERDIFP=A(94):Y=A(95):FUEL=A
(96):PEOPLE=A(97):UL=A(98):SPECIAL=A(99):ENGINE=A(100):ZZ=
A(101):AB=A(102):GR=A(103):RH=A(104):H=A(105):D=A(106):PIN
I=A(107):PTI=A(108):M=A(109):EFPA=A(110):RHO(2)=A(111):MM=
A(112):M(2)=A(113)
880 CRUISEV=A(114):CRU=A(115):CRU2=A(116):MAXF=A(117):
MAXF2=A(118):MAXCRU1=A(119):ALT=A(120):TEMP=A(121):LL=A(12
2):G=123:LL=LL+1:FOR I=1 TO LL:O(I)=A(G):G=G+1:NEXT
I:G=G+1+LL:G1=G+1+2*LL:G2=G1+1+2*LL:G3=G2+1+2*LL:G4=G3+1+2
*LL
```

```
890 FOR I=1 TO 2:FOR J=1 TO LL:PINF(I,J)=A(G):POF(I,J)
=A(G1):PPF(I,J)=A(G2):PTF(I,J)=A(G3):TM(I,J)=A(G4):G=G+1:G
1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:NEXT J,I:CLOSE #1:LL=LL-
1:RETURN 700
900 OPEN "B:DATA4" FOR INPUT AS #1:FOR I=1 TO LL(2):INPUT
#1, A(I):NEXT I:CLOSE #1
910 SGW=A(1):GW1=A(2):WE=A(3):VTIPMAX=A(4):R=A(5):OMEGA=
A(6):CT=A(7):SIGMA=A(8):B=A(9):C=A(10):AR=A(11):CL=A(12):C
LALPHA=A(13):CDO=A(14):DL=A(15):MBL=A(16):MU=A(17):MAXFVEL
=A(18):TIPLOSS=A(19):PIN=A(20):PO=A(21):PT=A(22):HP=A(23):
PERINDP=A(24)
920 V3=24:FOR I=1 TO 3:FOR J=1 TO 15:V3=V3+1:Q=J+24:W((Q-
24),I)=A(V3):NEXT J,I:FOR I=1 TO 3:W2A(I)=A(I+69):W2B(I)
=A(I+72):W6A(I)=A(I+75):W6B(I)=A(I+78):W6C(I)=A(I+81):NEXT
I:N=A(85):WE(N)=A(86):GW(N)=A(87):DL(N-1)=A(88):FM(N-1)=A(
89):FL=A(90):IRLG=A(91)
930 NW=A(92):PERDIFW=A(93):PERDIFP=A(94):Y=A(95):FUEL=
A(96):PEOPLE=A(97):UL=A(98):SPECIAL=A(99):ENGINE=A(100):ZZ
=A(101):AB=A(102):GR=A(103):RH=A(104):H=A(105):D=A(106):PI
NI=A(107):PTI=A(108):M=A(109):EFPA=A(110):RHO(2)=A(111):MM
=A(112):M(2)=A(113)
940 CRUISEV=A(114):CRU=A(115):CRU2=A(116):MAXF=A(117):MAX
F2=A(118):MAXCRU1=A(119):ALT=A(120):TEMP=A(121):LL=A(122):
TR=A(123):TRPM=A(124):OMEGAT=A(125):TCDO=A(126):BT=A(127):
TAR=A(128):TRC=A(129):TTR=A(130):CTTR=A(131):TRB=A(132):SI
GMAT=A(133):V=A(134)
950 SPAN=A(135):S=A(136):SWP=A(137):SWEEP=A(138):LAVS=A
(139):VSAR=A(140):BETA2=A(141):T=A(142):T2=A(143):T3=A(144
):CLATR=A(145):ALTR=A(146):ALTRDEG=A(147):TL=A(148):G=149:
LL=LL+1:FOR I=1 TO LL:O(I)=A(G):G=G+1:NEXT I:G=G+1+LL:G1=
G+1+2*LL:G2=G1+1+2*LL
960 G3=G2+1+2*LL:G4=G3+1+2*LL:FOR I=1 TO 2:FOR J=1 TO
LL:PINF(I,J)=A(G):POF(I,J)=A(G1):PPF(I,J)=A(G2):PTF(I,J)=A
(G3):TM(I,J)=A(G4):G=G+1:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:N
EXT J,I
970 G5=G4+2:G6=G5+2:G7=G6+2:FOR I=1 TO 2:PITR(I)=A(G4):
POTR(I)=A(G5):PTTR(I)=A(G6):CLTR(I)=A(G7):G4=G4+1:G5=G5+1:
G6=G6+1:G7=G7+1:NEXT I:G8=G7+1+2*(LL-1):G9=G8+1+2*(LL-1)
980 FOR I=1 TO 2:FOR J=2 TO LL:PITRF(I,J)=A(G7):POTRF(I,J)
=A(G8):PTTRF(I,J)=A(G9):G7=G7+1:G8=G8+1:G9=G9+1:NEXT J,I:
G10=G9+1+2*LL:G11=G10+1+2*LL:G12=G11+1+2*LL:G13=G12+1+2*LL
:G14=G13+1+2*LL
990 FOR I=1 TO 2:FOR J=1 TO LL:TTM(I,J)=A(G9):TRT(I,J)=
A(G10):L(I,J)=A(G11):VERSTAB(I,J)=A(G12):PTTRVSF(I,J)=A(G1
3):PITRFI(I,J)=A(G14):G9=G9+1:G10=G10+1:G11=G11+1:G12=G12+
1:G13=G13+1:G14=G14+1:NEXT J,I:LL=LL-1:CLOSE #1:RETURN 700
1000 '          *** PAUSE SUBROUTINE  ***
1010 '
1020 '
1030 IF AP=1 THEN LOCATE 25,79,0 ELSE LOCATE 25,27,0:PRINT
"press any key to continue"
```

```
1040 A$=INKEY$:IF A$="" THEN 1030
1050 RETURN
1060 LOCATE 1,1,0
1070 OPEN "B:DATA5" FOR INPUT AS #1:FOR I=1 TO LL(3):INPUT
#1, A(I):NEXT I:CLOSE #1
1080 SGW=A(1):GW1=A(2):WE=A(3):VTIPMAX=A(4):R=A(5):OMEGA=
A(6):CT=A(7):SIGMA=A(8):B=A(9):C=A(10):AR=A(11):CL=A(12):C
LALPHA=A(13):CDO=A(14):DL=A(15):MBL=A(16):MU=A(17):MAXFVEL
=A(18):TIPLOSS=A(19):PIN=A(20):PO=A(21):PT=A(22):HP=A(23):
PERINDP=A(24)
1090 V3=24:FOR I=1 TO 3:FOR J=1 TO 15:V3=V3+1:Q=J+24:W((Q-
24),I)=A(V3):NEXT J,I:FOR I=1 TO 3:W2A(I)=A(I+69):W2B(I)
=A(I+72):W6A(I)=A(I+75):W6B(I)=A(I+78):W6C(I)=A(I+81):NEXT
I:N=A(85):WE(N)=A(86):GW(N)=A(87):DL(N-1)=A(88):FM(N-
1)=A(89):FL=A(90):IRLG=A(91)
1100 NW=A(92):PERDIFW=A(93):PERDIFP=A(94):Y=A(95):FUEL=
A(96):PEOPLE=A(97):UL=A(98):SPECIAL=A(99):ENGINE=A(100):ZZ
=A(101):AB=A(102):GR=A(103):RH=A(104):H=A(105):D=A(106):PI
NI=A(107):PTI=A(108):M=A(109):EFPA=A(110):RHO(2)=A(111):MM
=A(112):M(2)=A(113)
1110 CRUISEV=A(114):CRU=A(115):CRU2=A(116):MAXF=A(117):MAX
F2=A(118):MAXCRU1=A(119):ALT=A(120):TEMP=A(121):LL=A(122):
TR=A(123):TRPM=A(124):OMEGAT=A(125):TCDO=A(126):BT=A(127):
TAR=A(128):TRC=A(129):TTR=A(130):CTTR=A(131):TRB=A(132):SI
GMAT=A(133):V=A(134)
1120 SPAN=A(135):S=A(136):SWP=A(137):SWEEP=A(138):LAVS=A
(139):VSAR=A(140):BETA2=A(141):T=A(142):T2=A(143):T3=A(144
):CLATR=A(145):ALTR=A(146):ALTRDEG=A(147):TL=A(148):BLTW=A
(149):CM=A(150):THT=A(151):AM=A(152):AMAX=A(153):PINIGE=A(
154):PTTI=A(155)
1130 RSHP=A(156):STYPE=A(157):ICESHD=A(158):STRTIN=A(159):
INLET=A(160):BARR=A(161):PARTSEP=A(162):EAPS=A(163):HDIF=A
(164):INRED=A(165):EEDS=A(166):RSHP1=A(167):RSHP2=A(168):R
SHP3=A(169):RSHP1A=A(170):RSHP2A=A(171):RSHP3A=A(172):ESHP
=A(173):LOSS=A(174)
1140 G=175:LL=LL+1:FOR I=1 TO LL:O(I)=A(G):G=G+1:NEXT
I:G=G+1+LL:G1=G+1+2*LL:G2=G1+1+2*LL
1150 G3=G2+1+2*LL:G4=G3+1+2*LL:FOR I=1 TO 2:FOR J=1 TO
LL:PINF(I,J)=A(G):POF(I,J)=A(G1):PPF(I,J)=A(G2):PTF(I,J)=A
(G3):TM(I,J)=A(G4):G=G+1:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:N
EXT J,I
1160 G5=G4+2:G6=G5+2:G7=G6+2:FOR I=1 TO 2:PITR(I)=A(G4):
POTR(I)=A(G5):PTTR(I)=A(G6):CLTR(I)=A(G7):G4=G4+1:G5=G5+1:
G6=G6+1:G7=G7+1:NEXT I:G8=G7+1+2*(LL-1):G9=G8+1+2*(LL-1)
1170 FOR I=1 TO 2:FOR J=2 TO LL:PITRF(I,J)=A(G7):POTRF
(I,J)=A(G8):PTTRF(I,J)=A(G9):G7=G7+1:G8=G8+1:G9=G9+1:NEXT
J,I:G10=G9+1+2*LL:G11=G10+1+2*LL:G12=G11+1+2*LL:G13=G12+1+
2*LL:G14=G13+1+2*LL
1180 FOR I=1 TO 2:FOR J=1 TO LL:TTM(I,J)=A(G9):TRT(I,J)
=A(G10):L(I,J)=A(G11):VERSTAB(I,J)=A(G12):PTTRVSF(I,J)=A(G
13):PITRFI(I,J)=A(G14):G9=G9+1:G10=G10+1:G11=G11+1:G12=G12
+1:G13=G13+1:G14=G14+1:NEXT J,I
1190 G15=G14+1:G16=G15+1+2*LL:G17=G16+1+2*LL:G18=G17+1+2*
LL:G19=G18+1+2*LL:G20=G19+1+2*LL:G21=G20+1+2*LL
1200 FOR I=1 TO 2:FOR J=1 TO LL:AL90(I,J)=A(G15):AL270
(I,J)=A(G16):M90(I,J)=A(G17):MCRIT(I,J)=A(G18):PS(I,J)=A(G
19):PM(I,J)=A(G20):PTT(I,J)=A(G21):G15=G15+1:G16=G16+1:G17
=G17+1:G18=G18+1:G19=G19+1:G20=G20+1:G21=G21+1:NEXT
J,I:LL=LL-1:CLOSE #1:RETURN 700
1210 RETURN
1220 OPEN "B:DATA6" FOR INPUT AS #1:FOR I=1 TO LL(4):INPUT
#1, A(I):NEXT I:CLOSE #1
1230 SGW=A(1):GW1=A(2):WE=A(3):VTIPMAX=A(4):R=A(5):OMEGA=
A(6):CT=A(7):SIGMA=A(8):B=A(9):C=A(10):AR=A(11):CL=A(12):C
LALPHA=A(13):CDO=A(14):DL=A(15):MBL=A(16):MU=A(17):MAXFVEL
=A(18):TIPLOSS=A(19):PIN=A(20):PO=A(21):PT=A(22):HP=A(23):
PERINDP=A(24)
1240 V3=24:FOR I=1 TO 3:FOR J=1 TO 15:V3=V3+1:Q=J+24:W((Q-
24),I)=A(V3):NEXT J,I:FOR I=1 TO 3:W2A(I)=A(I+69):
W2B(I)=A(I+72):W6A(I)=A(I+75):W6B(I)=A(I+78):W6C(I)=A(I+81
):NEXT I:N=A(85):WE(N)=A(86):GW(N)=A(87):DL(N-
1)=A(88):FM(N-1)=A(89):FL=A(90):IRLG=A(91)
1250 NW=A(92):PERDIFW=A(93):PERDIFP=A(94):Y=A(95):FUEL=
A(96):PEOPLE=A(97):UL=A(98):SPECIAL=A(99):ENGINE=A(100):ZZ
=A(101):AB=A(102):GR=A(103):RH=A(104):H=A(105):D=A(106):PI
NI=A(107):PTI=A(108):M=A(109):EFPA=A(110):RHO(2)=A(111):MM
=A(112):M(2)=A(113)
1260 CRUISEV=A(114):CRU=A(115):CRU2=A(116):MAXF=A(117):MAX
F2=A(118):MAXCRU1=A(119):ALT=A(120):TEMP=A(121):LL=A(122):
TR=A(123):TRPM=A(124):OMEGAT=A(125):TCDO=A(126):BT=A(127):
TAR=A(128):TRC=A(129):TTR=A(130):CTTR=A(131):TRB=A(132):SI
GMAT=A(133):V=A(134)
1270 SPAN=A(135):S=A(136):SWP=A(137):SWEEP=A(138):LAVS=A
(139):VSAR=A(140):BETA2=A(141):T=A(142):T2=A(143):T3=A(144
):CLATR=A(145):ALTR=A(146):ALTRDEG=A(147):TL=A(148):BLTW=A
(149):CM=A(150):THT=A(151):AM=A(152):AMAX=A(153):PINIGE=A(
154):PTTI=A(155)
1280 RSHP=A(156):STYPE=A(157):ICESHD=A(158):STRTIN=A(159):
INLET=A(160):BARR=A(161):PARTSEP=A(162):EAPS=A(163):HDIF=A
(164):INRED=A(165):EEDS=A(166):RSHP1=A(167):RSHP2=A(168):R
SHP3=A(169):RSHP1A=A(170):RSHP2A=A(171):RSHP3A=A(172):ESHP
=A(173):LOSS=A(174)
1290 ENG=A(175):EN=A(176):TRPWR=A(177):TRWT=A(178):NGW=A
(179):NPT=A(180):NDL=A(181):NFM=A(182):NPERINDP=A(183):NPE
RDIFP=A(184):NPERDIFW=A(185):G=186:LL=LL+1:FOR I=1 TO
LL:O(I)=A(G):G=G+1:NEXT I:G=G+1+LL:G1=G+1+2*LL:G2=G1+1
+2*LL
1300 G3=G2+1+2*LL:G4=G3+1+2*LL:FOR I=1 TO 2:FOR J=1 TO
LL:PINF(I,J)=A(G):POF(I,J)=A(G1):PPF(I,J)=A(G2):PTF(I,J)=A
(G3):TM(I,J)=A(G4):G=G+1:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:N
EXT J,I
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1310 G5=G4+2:G6=G5+2:G7=G6+2:FOR I=1 TO 2:PITR(I)=A(G4)
:POTR(I)=A(G5):PTTR(I)=A(G6):CLTR(I)=A(G7):G4=G4+1:G5=G5+1
:G6=G6+1:G7=G7+1:NEXT I:G8=G7+1+2*(LL-1):G9=G8+1+2*(LL-1)
1320 FOR I=1 TO 2:FOR J=2 TO LL:PITRF(I,J)=A(G7):POTRF
(I,J)=A(G8):PTTRF(I,J)=A(G9):G7=G7+1:G8=G8+1:G9=G9+1:NEXT
J,I:G10=G9+1+2*LL:G11=G10+1+2*LL:G12=G11+1+2*LL:G13=G12+1+
2*LL:G14=G13+1+2*LL
1330 FOR I=1 TO 2:FOR J=1 TO LL:TTM(I,J)=A(G9):TRT(I,J)
=A(G10):L(I,J)=A(G11):VERSTAB(I,J)=A(G12):PTTRVSF(I,J)=A(G
13):PITRFI(I,J)=A(G14):G9=G9+1:G10=G10+1:G11=G11+1:G12=G12
+1:G13=G13+1:G14=G14+1:NEXT J,I
1340 G15=G14+1:G16=G15+1+2*LL:G17=G16+1+2*LL:G18=G17+1+2*
LL:G19=G18+1+2*LL:G20=G19+1+2*LL:G21=G20+1+2*LL
1350 FOR I=1 TO 2:FOR J=1 TO LL:AL90(I,J)=A(G15):AL270
(I,J)=A(G16):M90(I,J)=A(G17):MCRIT(I,J)=A(G18):PS(I,J)=A(G
19):PM(I,J)=A(G20):PTT(I,J)=A(G21):G15=G15+1:G16=G16+1:G17
=G17+1:G18=G18+1:G19=G19+1:G20=G20+1:G21=G21+1:NEXT J,I:
LL=LL-1
1360 G22=G21+1:G23=G22+1+ENG:G24=G23+1+ENG:G25=G24+1+ENG:
G26=G25+1+ENG:G27=G26+1+ENG:G28=G27+1+ENG:G29=G28+1+ENG:G3
0=G29+1+ENG:G31=G30+1+ENG:G32=G31+1+ENG:G33=G32+1+ENG:G34=
G33+1+ENG:G35=G34+1+ENG:G36=G35+1+ENG:G37=G36+1+ENG:G38=G3
7+1+ENG
1370 G39=G38+1+ENG:G40=G39+1+ENG:G41=G40+1+ENG
1380 FOR I=1 TO ENG:DW(I)=A(G22):SHP(I)=A(G23):SFC(I)=A
(G24):IC(I)=A(G25):OC(I)=A(G26):PMA(I)=A(G27):MTBMA(I)=A(G
28):MDT(I)=A(G29):MTBF(I)=A(G30):MTBR(I)=A(G31):RC(I)=A(G3
2):SV(I)=A(G33):AVAIL(I)=A(G34):RELY(I)=A(G35):MAINT(I)=A(
G36)
1390 LC(I)=A(G37):EWT(I)=A(G38):YO(I)=A(G39):YM(I)=A(G40):
NRPL(I)=A(G41):G22=G22+1:G23=G23+1:G24=G24+1:G25=G25+1:G26
=G26+1:G27=G27+1:G28=G28+1:G29=G29+1:G30=G30+1:G31=G31+1:G
32=G32+1:G33=G33+1:G34=G34+1:G35=G35+1:G36=G36+1
1400 G37=G37+1:G38=G38+1:G39=G39+1:G40=G40+1:G41=G41+1:
NEXT I:CLOSE #1:RETURN 700
1410 RETURN
1420 OPEN "B:DATA7" FOR INPUT AS #1:FOR I=1 TO LL(5):INPUT
#1, A(I):NEXT I:CLOSE #1
1430 SGW=A(1):GW1=A(2):WE=A(3):VTIPMAX=A(4):R=A(5):OMEGA=
A(6):CT=A(7):SIGMA=A(8):B=A(9):C=A(10):AR=A(11):CL=A(12):C
LALPHA=A(13):CDO=A(14):DL=A(15):MBL=A(16):MU=A(17):MAXFVEL
=A(18):TIPLOSS=A(19):PIN=A(20):PO=A(21):PT=A(22):HP=A(23):
PERINDP=A(24)
1440 V3=24:FOR I=1 TO 3:FOR J=1 TO 15:V3=V3+1:Q=J+24:W((Q-
24),I)=A(V3):NEXT J,I:FOR I=1 TO 3:W2A(I)=A(I+69):
W2B(I)=A(I+72):W6A(I)=A(I+75):W6B(I)=A(I+78):W6C(I)=A(I+81
):NEXT I:N=A(85):WE(N)=A(86):GW(N)=A(87):DL(N-1)=A(88):FM
(N-1)=A(89):FL=A(90):IRLG=A(91)
1450 NW=A(92):PERDIFW=A(93):PERDIFP=A(94):Y=A(95):FUEL=
A(96):PEOPLE=A(97):UL=A(98):SPECIAL=A(99):ENGINE=A(100):ZZ
=A(101):AB=A(102):GR=A(103):RH=A(104):H=A(105):D=A(106):PI
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NI=A(107):PTI=A(108):M=A(109):EFPA=A(110):RHO(2)=A(111):MM
=A(112):M(2)=A(113)
1460 CRUISEV=A(114):CRU=A(115):CRU2=A(116):MAXF=A(117):MAX
F2=A(118):MAXCRU1=A(119):ALT=A(120):TEMP=A(121):LL=A(122):
TR=A(123):TRPM=A(124):OMEGAT=A(125):TCDO=A(126):BT=A(127):
TAR=A(128):TRC=A(129):TTR=A(130):CTTR=A(131):TRB=A(132):SI
GMAT=A(133):V=A(134)
1470 SPAN=A(135):S=A(136):SWP=A(137):SWEEP=A(138):LAVS=A
(139):VSAR=A(140):BETA2=A(141):T=A(142):T2=A(143):T3=A(144
):CLATR=A(145):ALTR=A(146):ALTRDEG=A(147):TL=A(148):BLTW=A
(149):CM=A(150):THT=A(151):AM=A(152):AMAX=A(153):PINIGE=A(
154):PTTI=A(155)
1480 RSHP=A(156):STYPE=A(157):ICESHD=A(158):STRTIN=A(159):
INLET=A(160):BARR=A(161):PARTSEP=A(162):EAPS=A(163):HDIF=A
(164):INRED=A(165):EEDS=A(166):RSHP1=A(167):RSHP2=A(168):R
SHP3=A(169):RSHP1A=A(170):RSHP2A=A(171):RSHP3A=A(172):ESHP
=A(173):LOSS=A(174)
1490 ENG=A(175):EN=A(176):TRPWR=A(177):TRWT=A(178):NGW=A
(179):NPT=A(180):NDL=A(181):NFM=A(182):NPERINDP=A(183):NPE
RDIFP=A(184):NPERDIFW=A(185):FOR I=1 TO
3:SFC(I)=A(185+I):SHP(I)=A(188+I):WDOTF(I)=A(191+I):NEXT
I:BETAH=A(195):ALPHAH(1)=A(196)
1500 ALPHAH(2)=A(197):PHANTOM(1)=A(198):PHANTOM(2)=A(199):
MRV=A(200):MRP=A(201):FFR=A(202):MEV=A(203):ERSHPR=A(204):
EFFR=A(205):CRUPWR(1)=A(206):CRUPWR(2)=A(207):CRUFFR(1)=A(
208):CRUFFR(2)=A(209):TFUEL=A(210):TIME=A(211):NGW2=A(212)
:G=213
1510 LL=LL+1:FOR I=1 TO LL:O(I)=A(G):G=G+1:NEXT I:G=G+1+
LL:G1=G+1+2*LL:G2=G1+1+2*LL
1520 G3=G2+1+2*LL:G4=G3+1+2*LL:FOR I=1 TO 2:FOR J=1 TO
LL:PINF(I,J)=A(G):POF(I,J)=A(G1):PPF(I,J)=A(G2):PTF(I,J)=A
(G3):TM(I,J)=A(G4):G=G+1:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:N
EXT J,I
1530 G5=G4+2:G6=G5+2:G7=G6+2:FOR I=1 TO 2:PITR(I)=A(G4)
:POTR(I)=A(G5):PTTR(I)=A(G6):CLTR(I)=A(G7):G4=G4+1:G5=G5+1
:G6=G6+1:G7=G7+1:NEXT I:G8=G7+1+2*(LL-1):G9=G8+1+2*(LL-1)
1540 FOR I=1 TO 2:FOR J=2 TO LL:PITRF(I,J)=A(G7):POTRF
(I,J)=A(G8):PTTRF(I,J)=A(G9):G7=G7+1:G8=G8+1:G9=G9+1:NEXT
J,I:G10=G9+1+2*LL:G11=G10+1+2*LL:G12=G11+1+2*LL:G13=G12+1+
2*LL:G14=G13+1+2*LL
1550 FOR I=1 TO 2:FOR J=1 TO LL:TTM(I,J)=A(G9):TRT(I,J)
=A(G10):L(I,J)=A(G11):VERSTAB(I,J)=A(G12):PTTRVSF(I,J)=A(G
13):PITRFI(I,J)=A(G14):G9=G9+1:G10=G10+1:G11=G11+1:G12=G12
+1:G13=G13+1:G14=G14+1:NEXT J,I
1560 G15=G14+1:G16=G15+1+2*LL:G17=G16+1+2*LL:G18=G17+1+2*
LL:G19=G18+1+2*LL:G20=G19+1+2*LL:G21=G20+1+2*LL
1570 FOR I=1 TO 2:FOR J=1 TO LL:AL90(I,J)=A(G15):AL270
(I,J)=A(G16):M90(I,J)=A(G17):MCRIT(I,J)=A(G18):PS(I,J)=A(G
19):PM(I,J)=A(G20):PTT(I,J)=A(G21):G15=G15+1:G16=G16+1:G17
=G17+1:G18=G18+1:G19=G19+1:G20=G20+1:G21=G21+1:NEXT J,I:
LL=LL-1
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1580 G22=G21+1:G23=G22+1+ENG:G24=G23+1+ENG:G25=G24+1+ENG:
G26=G25+1+ENG:G27=G26+1+ENG:G28=G27+1+ENG:G29=G28+1+ENG:G3
0=G29+1+ENG:G31=G30+1+ENG:G32=G31+1+ENG:G33=G32+1+ENG:G34=
G33+1+ENG:G35=G34+1+ENG:G36=G35+1+ENG:G37=G36+1+ENG:G38=G3
7+1+ENG
1590 G39=G38+1+ENG:G40=G39+1+ENG:G41=G40+1+ENG
1600 FOR I=1 TO ENG:DW(I)=A(G22):SHP(I)=A(G23):SFC(I)=A
(G24):IC(I)=A(G25):OC(I)=A(G26):PMA(I)=A(G27):MTBMA(I)=A(G
28):MDT(I)=A(G29):MTBF(I)=A(G30):MTBR(I)=A(G31):RC(I)=A(G3
2):SV(I)=A(G33):AVAIL(I)=A(G34):RELY(I)=A(G35):MAINT(I)=A(
G36)
1610 LC(I)=A(G37):EWT(I)=A(G38):YO(I)=A(G39):YM(I)=A(G40):
NRPL(I)=A(G41):G22=G22+1:G23=G23+1:G24=G24+1:G25=G25+1:G26
=G26+1:G27=G27+1:G28=G28+1:G29=G29+1:G30=G30+1:G31=G31+1:G
32=G32+1:G33=G33+1:G34=G34+1:G35=G35+1:G36=G36+1
1620 G37=G37+1:G38=G38+1:G39=G39+1:G40=G40+1:G41=G41+1:
NEXT I:CLOSE #1:RETURN 700
1630 RETURN
1640 OPEN "B:DATA8" FOR INPUT AS #1:FOR I=1 TO LL(6):INPUT
#1, A(I):NEXT I:CLOSE #1
1650 SGW=A(1):GW1=A(2):WE=A(3):VTIPMAX=A(4):R=A(5):OMEGA=
A(6):CT=A(7):SIGMA=A(8):B=A(9):C=A(10):AR=A(11):CL=A(12):C
LALPHA=A(13):CDO=A(14):DL=A(15):MBL=A(16):MU=A(17):MAXFVEL
=A(18):TIPLOSS=A(19):PIN=A(20):PO=A(21):PT=A(22):HP=A(23):
PERINDP=A(24)
1660 V3=24:FOR I=1 TO 3:FOR J=1 TO 15:V3=V3+1:Q=J+24:W((Q-
24),I)=A(V3):NEXT J,I:FOR I=1 TO 3:W2A(I)=A(I+69):
W2B(I)=A(I+72):W6A(I)=A(I+75):W6B(I)=A(I+78):W6C(I)=A(I+81
):NEXT I:N=A(85):WE(N)=A(86):GW(N)=A(87):DL(N-
1)=A(88):FM(N-1)=A(89):FL=A(90):IRLG=A(91)
1670 NW=A(92):PERDIFW=A(93):PERDIFP=A(94):Y=A(95):FUEL=
A(96):PEOPLE=A(97):UL=A(98):SPECIAL=A(99):ENGINE=A(100):ZZ
=A(101):AB=A(102):GR=A(103):RH=A(104):H=A(105):D=A(106):PI
NI=A(107):PTI=A(108):M=A(109):EFPA=A(110):RHO(2)=A(111):MM
=A(112):M(2)=A(113)
1680 CRUISEV=A(114):CRU=A(115):CRU2=A(116):MAXF=A(117):MAX
F2=A(118):MAXCRU1=A(119):ALT=A(120):TEMP=A(121):LL=A(122):
TR=A(123):TRPM=A(124):OMEGAT=A(125):TCDO=A(126):BT=A(127):
TAR=A(128):TRC=A(129):TTR=A(130):CTTR=A(131):TRB=A(132):SI
GMAT=A(133):V=A(134)
1690 SPAN=A(135):S=A(136):SWP=A(137):SWEEP=A(138):LAVS=A
(139):VSAR=A(140):BETA2=A(141):T=A(142):T2=A(143):T3=A(144
):CLATR=A(145):ALTR=A(146):ALTRDEG=A(147):TL=A(148):BLTW=A
(149):CM=A(150):THT=A(151):AM=A(152):AMAX=A(153):PINIGE=A(
154):PTTI=A(155)
1700 RSHP=A(156):STYPE=A(157):ICESHD=A(158):STRTIN=A(159):
INLET=A(160):BARR=A(161):PARTSEP=A(162):EAPS=A(163):HDIF=A
(164):INRED=A(165):EEDS=A(166):RSHP1=A(167):RSHP2=A(168):R
SHP3=A(169):RSHP1A=A(170):RSHP2A=A(171):RSHP3A=A(172):ESHP
=A(173):LOSS=A(174)
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1710 ENG=A(175):EN=A(176):TRPWR=A(177):TRWT=A(178):NGW=A
(179):NPT=A(180):NDL=A(181):NFM=A(182):NPERINDP=A(183):NPE
RDIFP=A(184):NPERDIFW=A(185):FOR I=1 TO
3:SFC(I)=A(185+I):SHP(I)=A(188+I):WDOTF(I)=A(191+I):NEXT
I:BETAH=A(195):ALPHAH(1)=A(196)
1720 ALPHAH(2)=A(197):PHANTOM(1)=A(198):PHANTOM(2)=A(199):
MRV=A(200):RSHPREQ=A(201):FFR=A(202):MEV=A(203):ERSHPR=A(2
04):EFFR=A(205):CRUPWR(1)=A(206):CRUPWR(2)=A(207):CRUFFR(1
)=A(208):CRUFFR(2)=A(209):TFUEL=A(210):TIME=A(211):NGW2=A(
212):PTF1=A(213)
1730 PDGW2=A(214):DIF=A(215):NGW3=A(216):MCV=A(217):VVERT=
A(218):MHA=A(219):SC=A(220):BW=A(221):BH=A(222):FL=A(223):
VEFPA=A(224):MCSHP=A(225):T2FUEL=A(226):LS4=A(227)G=228
1740 LL=LL+1:FOR I=1 TO LL:O(I)=A(G):G=G+1:NEXT I:G=G+1+
LL:G1=G+1+2*LL:G2=G1+1+2*LL
1750 G3=G2+1+2*LL:G4=G3+1+2*LL:FOR I=1 TO 2:FOR J=1 TO LL:
PINF(I,J)=A(G):POF(I,J)=A(G1):PPF(I,J)=A(G2):PTF(I,J)=A(G3
):TM(I,J)=A(G4):G=G+1:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:NEXT
J,I
1760 G5=G4+2:G6=G5+2:G7=G6+2:FOR I=1 TO 2:PITR(I)=A(G4):
POTR(I)=A(G5):PTTR(I)=A(G6):CLTR(I)=A(G7):G4=G4+1:G5=G5+1:
G6=G6+1:G7=G7+1:NEXT I:G8=G7+1+2*(LL-1):G9=G8+1+2*(LL-1)
1770 FOR I=1 TO 2:FOR J=2 TO LL:PITRF(I,J)=A(G7):POTRF
(I,J)=A(G8):PTTRF(I,J)=A(G9):G7=G7+1:G8=G8+1:G9=G9+1:NEXT
J,I:G10=G9+1+2*LL:G11=G10+1+2*LL:G12=G11+1+2*LL:G13=G12+1+
2*LL:G14=G13+1+2*LL
1780 FOR I=1 TO 2:FOR J=1 TO LL:TTM(I,J)=A(G9):TRT(I,J)
=A(G10):L(I,J)=A(G11):VERSTAB(I,J)=A(G12):PTTRVSF(I,J)=A(G
13):PITRFI(I,J)=A(G14):G9=G9+1:G10=G10+1:G11=G11+1:G12=G12
+1:G13=G13+1:G14=G14+1:NEXT J,I
1790 G15=G14+1:G16=G15+1+2*LL:G17=G16+1+2*LL:G18=G17+1+2*
LL:G19=G18+1+2*LL:G20=G19+1+2*LL:G21=G20+1+2*LL
1800 FOR I=1 TO 2:FOR J=1 TO LL:AL90(I,J)=A(G15):AL270
(I,J)=A(G16):M90(I,J)=A(G17):MCRIT(I,J)=A(G18):PS(I,J)=A(G
19):PM(I,J)=A(G20):PTT(I,J)=A(G21):G15=G15+1:G16=G16+1:G17
=G17+1:G18=G18+1:G19=G19+1:G20=G20+1:G21=G21+1:NEXT J,I
1810 G22=G21+1:G23=G22+1+ENG:G24=G23+1+ENG:G25=G24+1+ENG:
G26=G25+1+ENG:G27=G26+1+ENG:G28=G27+1+ENG:G29=G28+1+ENG:G3
0=G29+1+ENG:G31=G30+1+ENG:G32=G31+1+ENG:G33=G32+1+ENG:G34=
G33+1+ENG:G35=G34+1+ENG:G36=G35+1+ENG:G37=G36+1+ENG:G38=G3
7+1+ENG
1820 G39=G38+1+ENG:G40=G39+1+ENG:G41=G40+1+ENG
1830 FOR I=1 TO ENG:DW(I)=A(G22):SHP(I)=A(G23):SFC(I)=
A(G24):IC(I)=A(G25):OC(I)=A(G26):PMA(I)=A(G27):MTBMA(I)=A(
G28):MDT(I)=A(G29):MTBF(I)=A(G30):MTBR(I)=A(G31):RC(I)=A(G
32):SV(I)=A(G33):AVAIL(I)=A(G34):RELY(I)=A(G35):MAINT(I)=A
(G36)
1840 LC(I)=A(G37):EWT(I)=A(G38):YO(I)=A(G39):YM(I)=A(G40):
NRPL(I)=A(G41):G22=G22+1:G23=G23+1:G24=G24+1:G25=G25+1:G26
=G26+1:G27=G27+1:G28=G28+1:G29=G29+1:G30=G30+1:G31=G31+1:G
32=G32+1:G33=G33+1:G34=G34+1:G35=G35+1:G36=G36+1
```

```
1850 G37=G37+1:G38=G38+1:G39=G39+1:G40=G40+1:G41=G41+1:
NEXT I:CLOSE #1:LL=LL-1:RETURN 700
1860 CLS:LOCATE 10,25,1:INPUT "ARE YOU SURE YOU WANT TO
QUIT (Y/N)";A$:IF A$="y" THEN GOTO 1880 ELSE IF A$="Y"
GOTO 1880 ELSE IF A$="n" GOTO 700 ELSE IF A$="N" GOTO 700
ELSE
1870 LOCATE 24,25,1:INPUT "you must enter (y/n) try
again";A$:IF A$="y" THEN GOTO 1880 ELSE IF A$="Y" GOTO
1880 ELSE IF A$="n" GOTO 700 ELSE IF A$="N" GOTO 700 ELSE
GOTO 1870
1880 CLS:LOCATE 10,30,1:PRINT "PROGRAM TERMINATES":LOCATE
12,20,1:PRINT "MACHINE WILL SELF DESTRUCT IN 5
SECONDS":LOCATE 14,34,1:PRINT "GOOD LUCK":LOCATE
16,34,0:PRINT "MR. PHELPS":FOR I=1 TO 9500:NEXT I:SYSTEM
1890 '
1900 '
1910 '    FLASH-UP WINDOWS (used in this program)
1920 '    (c) COPYRIGHT THE SOFTWARE BOTTLING COMPANY
```

C. CHAPTER ONE

```
10 '******************************************************
20 '
30 '                         CHAPTER ONE
40 '
50 '                      PROGRAM OPERATION
60 '
70 '******************************************************
80 '
90 '
100 CLS:PRINT "~C=ALL/":PRINT "~L=CH1/"
110 COLOR 1,1,1:CLS:PRINT "~W=WIN1/":INPUT;"",X:ON X GOTO
120,120,130
120 CLS:PRINT "~C=ALL/":PRINT "~W=WIN4/":INPUT;"",X1:ON X1
GOTO 120,120,130
130 CLS:PRINT "~C=ALL/":PRINT "~W=WIN2/":INPUT;"",X2:ON X2
GOTO 140,140,150
140 CLS:PRINT "~C=ALL/":PRINT "~W=WIN6/":INPUT;"",X3:ON X3
GOTO 140,140,150
150 CLS:PRINT "~C=ALL/":PRINT "~W=WIN3/":INPUT;"",X4:ON X4
GOTO 160,160,170
160 CLS:PRINT "~C=ALL/":PRINT "~W=WIN5/":INPUT;"",X4:ON X4
GOTO 160,160,170
170 PRINT "~W=LOADNOTE/":CHAIN "HD1",,ALL
```

D. CHAPTER TWO

```
10 KEY(5) OFF
20 '*******************************************************
30 '
40 '                 MAIN ROTOR DESIGN
50 '
60 '*******************************************************
70 '
80 '
90 '          ***  CHAPTER TWO MAIN PROGRAM  ***
100 '
110 CLS:PRINT "~C=ALL/":PRINT "~L=HELO/"
120 KEY(9) ON
130 ON KEY(9) GOSUB 140
140 GOTO 160
150 RETURN
160 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=CHP2/":INPUT;"",X
170 IF X=0 THEN PRINT "~W=NOENTRY/":LOCATE 23,1,0:PRINT "
":GOSUB 2280:GOTO 220 ELSE
180 COLOR 15,1,1:IF X=1 THEN GOSUB 1260 ELSE IF X=2 THEN
GOSUB 1340 ELSE IF X=3 THEN GOSUB 1410 ELSE IF X=4 THEN
GOSUB 1480 ELSE IF X=5 THEN GOSUB 1580 ELSE IF X=6 THEN
GOSUB 1640 ELSE
190 IF X=7 THEN GOSUB 1710 ELSE IF X=8 THEN GOSUB 1840
ELSE IF X=9 THEN GOSUB 1920 ELSE IF X=10 THEN GOSUB 2030
ELSE IF X=12 THEN GOSUB 2110 ELSE IF X=13 GOTO 550 ELSE IF
X=15 GOTO 280 ELSE
200 IF X=16 THEN GOSUB 560 ELSE IF X=17 THEN GOSUB 820
ELSE IF X=18 THEN GOSUB 1090 ELSE IF X=19 THEN CLS:PRINT
"~W=LOADNOTE/":CHAIN "HD1",,ALL ELSE
210 '
220 CLS:LOCATE 25,27,0:PRINT "
":LOCATE 23,1,0:PRINT "    ":GOTO 120
230 LOCATE 25,20,1:PRINT "you must input a number from 1-
18 try again":GOTO 180
240 '
250 '              ****  DATA ENTRY ****
260 '
270 '
280 CLS:LOCATE 1,30,1:PRINT "CHAPTER TWO DATA ENTRY"
290 LOCATE 3,5,1:PRINT " 1.  SPECIFICATION GROSS WEIGHT"
300 PRINT TAB(5) " 2.  ROUGH ESTIMATE GROSS WEIGHT"
310 PRINT TAB(5) " 3.  ESTIMATE OF MANUFACTURER'S EMPTY
WEIGHT"
320 PRINT TAB(5) " 4.  MAXIMUM TIP VELOCITY"
330 PRINT TAB(5) " 5.  ROTOR RADIUS"
340 PRINT TAB(5) " 6.  ROTATIONAL VELOCITY"
350 PRINT TAB(5) " 7.  THRUST COEFFICIENT"
360 PRINT TAB(5) " 8.  BLADE SOLIDITY"
```

```
370 PRINT TAB(5) " 9.  NUMBER OF MAIN ROTOR BLADES"
380 PRINT TAB(5) "10.  BLADE CHORD"
390 PRINT TAB(5) "11.  BLADE ASPECT RATIO"
400 PRINT TAB(5) "12.  AVERAGE LIFT COEFFICIENT"
410 PRINT TAB(5) "13.  BLADE LIFT CURVE SLOPE"
420 PRINT TAB(5) "14.  BLADE DRAG COEFFICIENT"
430 PRINT TAB(5) "15.  DISC LOADING"
440 PRINT TAB(5) "16.  MAXIMUM ADVANCE RATIO"
450 PRINT TAB(5) "17.  MAXIMUM BLADE LOADING"
460 PRINT TAB(5) "18.  MAXIMUM FORWARD VELOCITY"
470 PRINT TAB(5) "19.  RETURN TO CHAPTER TWO MENU"
480 LOCATE 23,26,1:INPUT "WHICH DO YOU WANT TO ENTER";X:IF
X=1 THEN LOCATE 3,55,1:INPUT SGW:LOCATE 23,54,1:PRINT "
":GOTO 480 ELSE IF X=2 THEN LOCATE 4,55,1:INPUT GW1:LOCATE
23,54,1:PRINT " ":GOTO 480 ELSE
490 IF X=3 THEN LOCATE 5,55,1:INPUT WE:LOCATE
23,54,1:PRINT " ":GOTO 480 ELSE IF X=4 THEN LOCATE
6,55,1:INPUT VTIPMAX:LOCATE 23,54,1:PRINT " ":GOTO 480
ELSE IF X=5 THEN LOCATE 7,55,1:INPUT R:LOCATE
23,54,1:PRINT " ":GOTO 480 ELSE
500 IF X=6 THEN LOCATE 8,55,1:INPUT OMEGA:LOCATE
23,54,1:PRINT " ":GOTO 480 ELSE IF X=7 THEN LOCATE
9,55,1:INPUT CT:LOCATE 23,54,1:PRINT " ":GOTO 480 ELSE IF
X=8 THEN LOCATE 10,55,1:INPUT SIGMA:LOCATE 23,54,1:PRINT "
":GOTO 480 ELSE
510 IF X=9 THEN LOCATE 11,55,1:INPUT B:LOCATE
23,54,1:PRINT " ":GOTO 480 ELSE IF X=10 THEN LOCATE
12,55,1:INPUT C:LOCATE 23,54,1:PRINT "  ":GOTO 480 ELSE IF
X=11 THEN LOCATE 13,55,1:INPUT AR:LOCATE 23,54,1:PRINT "
":GOTO 480 ELSE
520 IF X=12 THEN LOCATE 14,55,1:INPUT CL:LOCATE
23,54,1:PRINT "  ":GOTO 480 ELSE IF X=13 THEN LOCATE
15,55,1:INPUT CLALPHA:LOCATE 23,54,1:PRINT "  ":GOTO 480
ELSE
530 IF X=14 THEN LOCATE 16,55,1:INPUT CDO:LOCATE
23,54,1:PRINT "  ":GOTO 480 ELSE IF X=15 THEN LOCATE
17,55,1:INPUT DL:LOCATE 23,54,1:PRINT "  ":GOTO 480 ELSE
IF X=16 THEN LOCATE 18,55,1:INPUT MU:LOCATE 23,54,1:PRINT
"  ":GOTO 480 ELSE
540 IF X=17 THEN LOCATE 19,55,1:INPUT MBL:PRINT "  ":GOTO
480 ELSE IF X=18 THEN LOCATE 20,55,1:INPUT MAXFVEL:PRINT "
":GOTO 480 ELSE IF X=19 GOTO 110
550 GOSUB 1260:GOSUB 1340:GOSUB 1410:GOSUB 1480:GOSUB
1840:GOSUB 1920:GOSUB 2110:GOTO 110
560 '          *******  PRINT DATA ON SCREEN  *******
570 '
580 '
590 CLS:LOCATE 2,25,1:PRINT "TABLE OF CHAPTER TWO RESULTS"
600 LOCATE 5,5,1:PRINT "SPECIFICATION GROSS
WEIGHT";TAB(50) SGW
610 PRINT TAB(5) "ROUGH ESTIMATE GROSS WEIGHT";TAB(50) GW1
```

```
620 PRINT TAB(5) "ESTIMATE OF MANUFACTURER'S EMPTY
WEIGHT";TAB(50) WE
630 PRINT TAB(5) "MAXIMUM TIP VELOCITY";TAB(50) VTIPMAX
640 PRINT TAB(5) "ROTOR RADIUS";TAB(50) R
650 PRINT TAB(5) "ROTATIONAL VELOCITY";TAB(50) OMEGA
660 PRINT TAB(5) "THRUST COEFFICIENT";TAB(50) CT
670 PRINT TAB(5) "BLADE SOLIDITY";TAB(50) SIGMA
680 PRINT TAB(5) "NUMBER OF MAIN ROTOR BLADES";TAB(50) B
690 PRINT TAB(5) "BLADE CHORD";TAB(50) C
700 PRINT TAB(5) "BLADE ASPECT RATIO";TAB(50) AR
710 PRINT TAB(5) "AVERAGE LIFT COEFFICIENT";TAB(50) CL
720 PRINT TAB(5) "BLADE LIFT CURVE SLOPE";TAB(50) CLALPHA
730 PRINT TAB(5) "BLADE DRAG COEFFICIENT";TAB(50) CDO
740 PRINT TAB(5) "DISC LOADING";TAB(50) DL
750 PRINT TAB(5) "MAXIMUM ADVANCE RATIO";TAB(50) MU
760 PRINT TAB(5) "MAXIMUM BLADE LOADING";TAB(50) MBL
770 PRINT TAB(5) "MAXIMUM FORWARD VELOCITY";TAB(50)
MAXFVEL
780 GOSUB 2280
790 RETURN 110
800 '
810 '
820 '          ********  PRINT OUT DATA  ********
830 '
840 '
850 CLS:LOCATE 23,1,0:PRINT "~W=PRINTER/":GOSUB
2280:LOCATE 25,27,0:PRINT "                           "
860 LPRINT TAB(25) "TABLE OF CHAPTER TWO
RESULTS":I$=CHR$(9)
870 LPRINT
880 LPRINT
890 LPRINT
900 LPRINT TAB(12) "SPECIFICATION GROSS WEIGHT";TAB(57)
SGW
910 LPRINT TAB(12) "ROUGH ESTIMATE GROSS WEIGHT";TAB(57)
GW1
920 LPRINT TAB(12) "ESTIMATE OF MANUFACTURER'S EMPTY
WEIGHT";TAB(57) WE
930 LPRINT TAB(12) "MAXIMUM TIP VELOCITY";TAB(57) VTIPMAX
940 LPRINT TAB(12) "ROTOR RADIUS";TAB(57) R
950 LPRINT TAB(12) "ROTATIONAL VELOCITY";TAB(57) OMEGA
960 LPRINT TAB(12) "THRUST COEFFICIENT";TAB(57) CT
970 LPRINT TAB(12) "BLADE SOLIDITY";TAB(57) SIGMA
980 LPRINT TAB(12) "NUMBER OF MAIN ROTOR BLADES";TAB(57) B
990 LPRINT TAB(12) "BLADE CHORD";TAB(57) C
1000 LPRINT TAB(12) "BLADE ASPECT RATIO";TAB(57) AR
1010 LPRINT TAB(12) "AVERAGE LIFT COEFFICIENT";TAB(57) CL
1020 LPRINT TAB(12) "BLADE LIFT CURVE SLOPE";TAB(57)
CLALPHA
1030 LPRINT TAB(12) "BLADE DRAG COEFFICIENT";TAB(57) CDO
1040 LPRINT TAB(12) "DISC LOADING";TAB(57) DL
```

```
1050 LPRINT TAB(12) "MAXIMUM ADVANCE RATIO";TAB(57) MU
1060 LPRINT TAB(12) "MAXIMUM BLADE LOADING";TAB(57) MBL
1070 LPRINT TAB(12) "MAXIMUM FORWARD VELOCITY";TAB(57)
MAXFVEL
1080 LPRINT CHR$ (12):RETURN 110
1090 '
1100 '
1110 '             *** STORE DATA ON FILE DISK ***
1120 '
1130 '
1140 A(1)=SGW:A(2)=GW1:A(3)=WE:A(4)=VTIPMAX:A(5)=R:A(6)=
OMEGA:A(7)=CT:A(8)=SIGMA:A(9)=B:A(10)=C:A(11)=AR:A(12)=CL:
A(13)=CLALPHA:A(14)=CDO:A(15)=DL:A(16)=MBL:A(17)=MU:A(18)=
MAXFVEL
1150 CLS:LOCATE 23,1,0:PRINT "~W=DISK/":GOSUB 2280:LOCATE
25,27,1:PRINT "                            ":LOCATE
23,1,0:PRINT "~W=SAVE/":Z=2:OPEN "B:DATA1" FOR OUTPUT AS
#1:PRINT #1, Z:FOR I=1 TO 10:PRINT #1, LL(I):NEXT I
1160 CLOSE #1
1170 OPEN "B:DATA2" FOR OUTPUT AS #1:FOR I=1 TO 18:PRINT
#1,A(I):NEXT I:CLOSE #1
1180 RETURN 120
1190 '
1200 '
1210 '            ***  CHAPTER TWO SUBROUTINES  ***
1220 '
1230 '
1240 '            ********  SECTION 2.1  *******
1250 '
1260 CLS:LOCATE 5,30,1:PRINT "*** SECTION 2.1 ***":LOCATE
7,27,0:PRINT "-ESTIMATE OF GROSS WEIGHT-":LOCATE
10,21,1:INPUT "ENTER SPECIFICATION GROSS WEIGHT";SGW
1270 GW1 = .8 * SGW:LOCATE 12,21,1:PRINT "ROUGH ESTIMATE
GROSS WEIGHT IS =";GW1
1280 LOCATE 23,22,1:INPUT "do you want to make any
changes? (y/n)";C$:IF C$="y" THEN GOTO 1260 ELSE IF C$="Y"
GOTO 1260 ELSE IF C$="n" GOTO 1300 ELSE IF C$="N" GOTO
1300 ELSE
1290 LOCATE 24,25,1:PRINT "you must enter (y/n) try
again":GOTO 1280
1300 IF X=13 THEN RETURN ELSE RETURN 120
1310 '
1320 '            ********  SECTION 2.2  *******
1330 '
1340 CLS:LOCATE 5,30,1:PRINT "*** SECTION 2.2 ***":PRINT "
":PRINT TAB(20) "-ESTIMATE OF MANUFACTURER'S EMPTY WEIGHT-
"
1350 LOCATE 10,5,1:INPUT "USING FIGURE 2-1 ENTER THE
MANUFACTURER'S EMPTY WEIGHT ESTIMATE";WE
1360 LOCATE 12,5,1:PRINT "MANUFACTURER'S EMPTY WEIGHT
ESTIMATE =";WE
```

```
1370 LOCATE 23,22,1:INPUT "do you want to make any changes
(y/n)";C$:IF C$="y" THEN GOTO 1340 ELSE IF C$="Y" GOTO
1340 ELSE IF C$="n" GOTO 1390 ELSE IF C$="N" GOTO 1390
ELSE
1380 LOCATE 24,25,1:PRINT "you must enter (y/n) try
again":GOTO 1370
1390 IF X=13 THEN RETURN ELSE RETURN 120
1400 '
1410 '           ********  SECTION 2.3  *******
1420 '
1430 VTIPMAX = .65 * A
1440 CLS:LOCATE 5,30,1:PRINT "*** SECTION 2.3 ***":LOCATE
7,22,0:PRINT "-CALCULATE THE MAXIMUM TIP VELOCITY-":LOCATE
9,25,0:PRINT "MAXIMUM TIP VELOCITY = ";VTIPMAX
1450 GOSUB 2280
1460 IF X=13 THEN RETURN ELSE RETURN 120
1470 '
1480 '           ********  SECTION 2.4  *******
1490 '
1500 CLS:LOCATE 5,30,1:PRINT "*** SECTION 2.4 ***":LOCATE
7,28,0:PRINT "-DETERMINE ROTOR RADIUS-"
1510 LOCATE 10,5,1:INPUT "USING FIGURE 2-2 AND HD-7
DETERMINE A VALUE OF DISK LOADING AND ENTER";DL
1520 R = SQR(SGW/(DL*PI))
1530 LOCATE 12,30,1:PRINT "ROTOR RADIUS =";R
1540 LOCATE 23,22,1:INPUT "do you want to make any changes
(y/n)";C$:IF C$="Y" THEN GOTO 1480 ELSE IF C$="y" GOTO
1480 ELSE IF C$="n" GOTO 1560 ELSE IF C$="N" GOTO 1560
ELSE
1550 LOCATE 24,25,1:PRINT "you must enter (y/n) try
again":GOTO 1540
1560 IF X=13 THEN GOTO 1570 ELSE RETURN 120
1570 '
1580 '           ********  SECTION 2.5  *******
1590 '
1600 OMEGA = VTIPMAX / R
1610 CLS:LOCATE 2,30,1:PRINT "*** SECTION 2.5 ***":LOCATE
4,20,0:PRINT "-DETERMINE FIRST-CUT ROTATIONAL VELOCITY-
":LOCATE 6,35,0:PRINT "OMEGA =";OMEGA
1620 '
1630 '
1640 '           ********  SECTION 2.6  *******
1650 '
1660 CT = SGW / (PI*(R^2)*RHO*((OMEGA*R)^2))
1670 LOCATE 14,30,1:PRINT "*** SECTION 2.6 ***":LOCATE
16,16,0:PRINT "-FIRST CUT DETERMINATION OF THRUST
COEFFICIENT-":LOCATE 18,30,0:PRINT "THRUST COEFFICIENT
=";CT
1680 GOSUB 2280:IF X=13 THEN GOTO 1690 ELSE RETURN 120
1690 '
1700 '
```

```
1710 '           ********  SECTION 2.7  *******
1720 '
1730 CLS:LOCATE 5,30,1:PRINT "*** SECTION 2.7 ***":LOCATE
7,27,0:PRINT "-DETERMINE BLADE SOLIDITY-"
1740 LOCATE 10,24,1:INPUT "ENTER MAXIMUM FORWARD
VELOCITY";MAXFVEL
1750 MU = MAXFVEL*1.687778 / (OMEGA*R)
1760 LOCATE 12,24,1:PRINT "MAXIMUM ADVANCE RATIO =";MU
1770 LOCATE 14,13,1:INPUT "DETERMINE MAXIMUM BLADE LOADING
FROM FIGURE 2-3 AND ENTER";MBL
1780 SIGMA = CT / MBL
1790 LOCATE 16,24,1:PRINT "BLADE SOLIDITY =";SIGMA
1800 LOCATE 23,22,1:INPUT "do you want to make any changes
(y/n)";C$:IF C$="y" THEN GOTO 1710 ELSE IF C$="Y" GOTO
1710 ELSE IF C$="n" GOTO 1820 ELSE IF C$="N" GOTO 1820
ELSE
1810 LOCATE 24,25,1:INPUT "you must enter (y/n) try
again":GOTO 1800
1820 IF X=13 THEN RETURN ELSE RETURN 120
1830 '
1840 '           ********  SECTION 2.8  *******
1850 '
1860 CLS:LOCATE 5,30,1:PRINT "*** SECTION 2.8 ***":PRINT "
":PRINT TAB(23) "-DETERMINE NUMBER OF ROTOR BLADES-"
1870 LOCATE 10,15,1:INPUT "ENTER YOUR SELECTION FOR NUMBER
OF ROTOR BLADES";B:PRINT " ":PRINT" ":PRINT TAB(15)
"NUMBER OF ROTOR BLADES =";B
1880 LOCATE 23,22,1:INPUT "do you want to make any changes
(y/n)";C$:IF C$="y" THEN GOTO 1840 ELSE IF C$="Y" GOTO
1840 ELSE IF C$="n" GOTO 1900 ELSE IF C$="N" GOTO 1900
ELSE
1890 LOCATE 24,25,1:INPUT "you must enter (y/n) try
again":GOTO 1880
1900 IF X=13 THEN RETURN ELSE RETURN 120
1910 '
1920 '           ********  SECTION 2.9  *******
1930 '
1940 C = (SIGMA*PI*R) / B
1950 AR = R / C
1960 CLS:LOCATE 5,30,1:PRINT "*** SECTION 2.9 ***":LOCATE
7,20,0:PRINT "-DETERMINE THE CHORD AND ASPECT RATIO-
":PRINT "":LOCATE 9,25,0:PRINT "ROTATIONAL VELOCITY
=";OMEGA:LOCATE 11,25,0:PRINT "CHORD =";C:LOCATE
13,25,0:PRINT "ASPECT RATIO =";AR
1970 LOCATE 16,15,1:INPUT "DO YOU WANT TO CHANGE THE
ROTATIONAL VELOCITY (Y/N)";B$:IF B$="y" THEN GOSUB 2380
ELSE IF B$="Y" THEN GOSUB 2380 ELSE IF B$="n" GOTO 1990
ELSE IF B$="N" GOTO 1990 ELSE
1980 LOCATE 24,25,1:INPUT "you must enter (y/n) try
again":GOTO 1970
1990 IF X=13 THEN GOTO 2000 ELSE RETURN 120
```

```
2000 '
2010 '
2020 '
2030 '          ********  SECTION 2.10  *******
2040 '
2050 CLS:LOCATE 5,30,1:PRINT "*** SECTION 2.10 ***":PRINT
" ":PRINT TAB(27) "-AVERAGE LIFT COEFFICIENT-"
2060 CL = (CT*6) / SIGMA
2070 LOCATE 10,25,1:PRINT "AVERAGE LIFT COEFFICIENT =";CL
2080 GOSUB 2280
2090 IF X=13 THEN RETURN ELSE RETURN 120
2100 '
2110 '          ********  SECTION 2.12  *******
2120 '
2130 CLS:LOCATE 5,30,1:PRINT "*** SECTION 2.12 ***":PRINT
" ":PRINT TAB(20) "-LIFT CURVE SLOPE AND DRAG COEFFICIENT-
"
2140 LOCATE 10,16,1:INPUT "ENTER LIFT CURVE SLOPE AT ZERO
ANGLE OF ATTACK";CLALPHA
2150 LOCATE 12,16,1:INPUT "ENTER DRAG COEFFICIENT AT ZERO
ANGLE OF ATTACK";CDO
2160 LOCATE 14,16,1:PRINT "LIFT CURVE SLOPE
=";CLALPHA:LOCATE 16,16,1:PRINT "DRAG COEFFICIENT =";CDO
2170 LOCATE 23,22,1:INPUT "do you want to amke any changes
(y/n)";C$:IF C$="y" THEN GOTO 2110 ELSE IF C$="Y" GOTO
2110 ELSE IF C$="n" GOTO 2190 ELSE IF C$="N" GOTO 2190
ELSE
2180 LOCATE 24,25,1:INPUT "you must enter (y/n) try
again":GOTO 2170
2190 RETURN 120
2200 '
2210 '
2220 '          ***  SECTION SUBROUTINES  ***
2230 '
2240 '
2250 '          *** PAUSE SUBROUTINE  ***
2260 '
2270 '
2280 IF AP=1 THEN LOCATE 25,79,0 ELSE LOCATE 25,27,0:PRINT
"press any key to continue"
2290 A$=INKEY$:IF A$="" THEN 2290
2300 RETURN
2310 LOCATE 1,1,0
2320 A$=INKEY$:IF A$="" THEN 2310
2330 RETURN
2340 '
2350 '          ***  SECTION 2.9 SUBROUTINE  ***
2360 '
2370 '
2380 CLS:LOCATE 10,25,1:INPUT "ENTER NEW ROTATIONAL
VELOCITY";OMEGA
```

```
2390 CT=GW1/(PI*(R^2)*RHO*((OMEGA*R)^2)):MU=MAXFVEL*
1.687778 /(OMEGA*R)
2400 LOCATE 12,25,1:PRINT "MAXIMUM ADVANCE RATIO =";MU
2410 LOCATE 14,10,1:INPUT "USE FIGURE 2-3 TO DETERMINE THE
MAXIMUM BLADE LOADING AND ENTER";MBL:SIGMA=CT/MBL
2420 LOCATE 16,25,1:PRINT "BLADE SOLIDITY
=";SIGMA:C=(SIGMA*PI*R)/B
2430 AR=R/C
2440 LOCATE 18,25,1:PRINT "CHORD =";C:LOCATE 20,25,1:PRINT
"ASPECT RATIO =";AR
2450 LOCATE 22,13,1:INPUT "do you want to change the
rotational velocity again (y/n)";F$
2460 IF F$="y" THEN GOTO 2380 ELSE IF F$="Y" GOTO 2380
ELSE IF F$="n" GOTO 2480 ELSE IF F$="N" GOTO 2480 ELSE
2470 LOCATE 24,25,1:INPUT "you must enter (y/n) try
again";F$:GOTO 2450
2480 RETURN 1960
2490 '
2500 '
```

E. CHAPTER THREE

```
10 KEY(5) OFF
20 GOTO 350
30 '          *** PAUSE SUBROUTINE  ***
40 '
50 '
60 IF AP=1 THEN LOCATE 25,79,0 ELSE LOCATE 25,27,0:PRINT
"press any key to continue"
70 A$=INKEY$:IF A$="" THEN 70
80 RETURN
90 '
100 '          ***  SECTION 2.9 SUBROUTINE  ***
110 '
120 '
130 FOR I=4 TO 23:LOCATE I,41,1:PRINT "
":NEXT I:LOCATE 10,42,1:INPUT "ENTER NEW ROTATIONAL
VELOCITY";OMEGA
140 CT=GW1/(PI*(R^2)*RHO*((OMEGA*R)^2)):MU=MAXFVEL/
(OMEGA*R)
150 LOCATE 12,42,1:PRINT "MAXIMUM ADVANCE RATIO =";MU
160 LOCATE 14,42,1:PRINT "YOUR MAXIMUM BLADE LOADING
=";MBL:SIGMA=CT/MBL:CL=(CT*6)/SIGMA
170 LOCATE 16,42,1:PRINT "BLADE SOLIDITY =";SIGMA
180 AR=R/C
190 LOCATE 18,42,1:PRINT "CHORD =";C:LOCATE 20,42,1:PRINT
"ASPECT RATIO =";AR
200 LOCATE 22,42,1:INPUT "change again (y/n)";F$:GOTO 210
210 IF F$="y" THEN GOTO 130 ELSE IF F$="Y" GOTO 130 ELSE
IF F$="n" GOTO 230 ELSE IF F$="N" GOTO 230 ELSE
220 LOCATE 23,42,1:INPUT "you must enter (y/n) try
again";F$:GOTO 210
230 RETURN
240 '
250 CT=GW(N)/(PI*(R^2)*RHO*((OMEGA*R)^2)):MU=MAXFVEL/
(OMEGA*R):SIGMA=(B*C)/(PI*R):GOSUB
260:CL=(CT*6)/SIGMA:RETURN
260 '
270 AR = R / C
280 FOR I=3 TO 23:LOCATE I,41,1:PRINT "
":NEXT I:LOCATE 4,47,1:PRINT "*** FROM SECTION 2.9
***":LOCATE 7,42,1:PRINT "ROTATIONAL VELOCITY
=";OMEGA:LOCATE 9,42,1:PRINT "CHORD =";C
290 LOCATE 11,42,1:PRINT "ASPECT RATIO =";AR:LOCATE
13,42,1:PRINT "ROTOR RADIUS";R
300 LOCATE 23,48,1:INPUT "any changes (y/n)";C$:IF C$="y"
THEN GOTO 320 ELSE IF C$="Y" GOTO 320 ELSE IF C$="n" THEN
RETURN ELSE IF C$="N" THEN RETURN ELSE
310 LOCATE 23,42,1:INPUT "you must enter (y/n) try
again";C$:IF C$="y" THEN GOTO 260 ELSE IF C$="Y" GOTO 260
```

```
ELSE IF C$="n" THEN RETURN ELSE IF C$="N" THEN RETURN ELSE
GOTO 310
320 IF W=1 THEN GOTO 1860 ELSE IF W=2 GOTO 1870 ELSE IF
W=3 GOTO 1880
330 '
340 '
350 '******************** CHAPTER THREE *****************
360 '
370 '          *** PRELIMINARY POWER CALCULATIONS ***
380 '
390 '
400 '             *** CHAPTER THREE MAIN PROGRAM ***
410 '
420 '
430 ERASE A:DIM A(500):CLS:PRINT "~C=ALL/":PRINT "~L=CH3/"
440 KEY(9) ON:ON KEY(9) GOSUB 450
450 AP=0:COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C3MAIN/":INPUT;"",X
460 COLOR 15,1,1:IF X=1 THEN GOSUB 1060 ELSE IF X=2 THEN
GOSUB 1220 ELSE IF X=3 THEN GOSUB 1540 ELSE IF X=4 THEN
GOSUB 1730 ELSE IF X=5 THEN GOSUB 2080 ELSE IF X=6 THEN
GOSUB 2130 ELSE IF X=7 THEN GOSUB 2270 ELSE IF X=8 THEN
GOSUB 2330 ELSE
470 IF X=9 THEN GOSUB 2540 ELSE IF X=10 THEN GOSUB 2620
ELSE IF X=11 THEN GOSUB 2770 ELSE IF X=12 THEN GOTO 1090
ELSE IF X=13 THEN GOSUB 4370 ELSE IF X=14 THEN GOSUB 4060
ELSE IF X=15 THEN GOSUB 660 ELSE IF X=16 THEN GOSUB 490
ELSE
480 IF X=17 THEN ERASE A:CH3=3:CLS:PRINT "~W=LOAD/":CHAIN
"HD1",,ALL
490 '
500 '
510 '                   *** STORE DATA ON FILE DISK ***
520 '
530 CLS:LOCATE 23,1,0:PRINT "~W=DISK/":GOSUB 60:LOCATE
25,27,1:PRINT "                            ":LOCATE
23,1,0:PRINT "~W=SAVE/"
540 A(1)=SGW:A(2)=GW1:A(3)=WE:A(4)=VTIPMAX:A(5)=R:A(6)=
OMEGA:A(7)=CT:A(8)=SIGMA:A(9)=B:A(10)=C:A(11)=AR:A(12)=CL:
A(13)=CLALPHA:A(14)=CDO:A(15)=DL:A(16)=MBL:A(17)=MU:A(18)=
MAXFVEL:A(19)=TIPLOSS:A(20)=PIN:A(21)=PO:A(22)=PT:A(23)=HP
:A(24)=PERINDP
550 V=24:FOR I=1 TO 3:FOR J=1 TO 15:V=V+1:Q=J+24:A(V)=W(Q-
24,I):NEXT J,I:FOR I=1 TO
3:A(I+69)=W2A(I):A(I+72)=W2B(I):A(I+75)=W6A(I):A(I+78)=W6B
(I):A(I+81)=W6C(I):NEXT I:A(85)=N:A(86)=WE(N):
A(87)=GW(N):A(88)=DL(N-1):A(89)=FM(N-
1):A(90)=FL:A(91)=IRLG
560 A(92)=NW:A(93)=PERDIFW:A(94)=PERDIFP:A(95)=Y:A(96)=
FUEL:A(97)=PEOPLE:A(98)=UL:A(99)=SPECIAL:A(100)=ENGINE:A(1
01)=ZZ:A(102)=AB:A(103)=GR:A(104)=RH:A(105)=H:A(106)=D:A(1
07)=PINI:A(108)=PTI:A(109)=M:A(110)=EFPA:A(111)=RHO(2):A(1
12)=MM:A(113)=M(2)
570 A(114)=CRUISEV:A(115)=CRU:A(116)=CRU2:A(117)=MAXF:
A(118)=MAXF2:A(119)=MAXCRU1:A(120)=ALT:A(121)=TEMP:A(122)=
LL:G=123:LL=LL+1:FOR I=1 TO LL:A(G)=O(I):G=G+1:NEXT
I:G=G+1+LL:G1=G+1+2*LL:G2=G1+1+2*LL:G3=G2+1+2*LL:G4=G3+1+2
*LL
580 FOR I=1 TO 2:FOR J=1 TO LL:A(G)=PINF(I,J):A(G1)=
POF(I,J):A(G2)=PPF(I,J):A(G3)=PTF(I,J):A(G4)=TM(I,J):G=G+1
:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:NEXT J,I
590 LL(1)=127+(12*LL):LL=LL-1
600 Z=3:OPEN "B:DATA1" FOR OUTPUT AS #1:PRINT #1, Z:FOR
I=1 TO 10:PRINT #1, LL(I):NEXT I:CLOSE #1
610 OPEN "B:DATA3" FOR OUTPUT AS #1:FOR I=1 TO LL(1):PRINT
#1, A(I):NEXT I:CLOSE #1:RETURN 440
620 '
630 '
640 '
650 '
660 '                          *** PRINT OUT DATA ***
670 '
680 '
690 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C3PRINT/":INPUT;"",PR:COLOR 15,1,1
700 AP=0:IF PR=1 THEN GOTO 730 ELSE IF PR=2 THEN
AP=1:GOSUB 1390 ELSE IF PR=3 THEN AP=1:GOSUB 2910 ELSE IF
PR=4 THEN AP=0:GOTO 440
710 'HE TABLE IS PRINTED PRESS ANY KEY AND RETURN TO THE
PRINT MENU.":GOSUB 40:IF PR=2 THEN AP=1:GOSUB 1410 ELSE
AP=1:GOSUB 2730
730 CLS:LOCATE 23,1,0:PRINT "~W=PRINTER/":GOSUB 60
740 LPRINT TAB(25) "TABLE OF CHAPTER THREE
RESULTS":I$=CHR$(9)
750 LPRINT
760 LPRINT
770 LPRINT
780 LPRINT TAB(12) "SPECIFICATION GROSS WEIGHT";TAB(57)
SGW
790 LPRINT TAB(12) "ROUGH ESTIMATE GROSS WEIGHT";TAB(57)
GW1
800 LPRINT TAB(12) "ESTIMATE OF MANUFACTURER'S EMPTY
WEIGHT";TAB(57) WE
810 LPRINT TAB(12) "MAXIMUM TIP VELOCITY";TAB(57) VTIPMAX
820 LPRINT TAB(12) "ROTOR RADIUS";TAB(57) R
830 LPRINT TAB(12) "ROTATIONAL VELOCITY";TAB(57) OMEGA
840 LPRINT TAB(12) "THRUST COEFFICIENT";TAB(57) CT
850 LPRINT TAB(12) "BLADE SOLIDITY";TAB(57) SIGMA
860 LPRINT TAB(12) "NUMBER OF MAIN ROTOR BLADES";TAB(57) B
870 LPRINT TAB(12) "BLADE CHORD";TAB(57) C
880 LPRINT TAB(12) "BLADE ASPECT RATIO";TAB(57) AR
890 LPRINT TAB(12) "AVERAGE LIFT COEFFICIENT";TAB(57) CL
```

```
900 LPRINT TAB(12) "BLADE LIFT CURVE SLOPE";TAB(57)
CLALPHA
910 LPRINT TAB(12) "BLADE DRAG COEFFICIENT";TAB(57) CDO
920 LPRINT TAB(12) "DISC LOADING";TAB(57) DL(N-1)
930 LPRINT TAB(12) "MAXIMUM ADVANCE RATIO";TAB(57) MU
940 LPRINT TAB(12) "MAXIMUM BLADE LOADING";TAB(57) MBL
950 LPRINT TAB(12) "MAXIMUM FORWARD VELOCITY";TAB(57)
MAXFVEL
960 LPRINT TAB(12) "TIPLOSS";TAB(57) TIPLOSS
970 LPRINT TAB(12) "INDUCED POWER IN HOVER OGE";TAB(57)
PIN
980 LPRINT TAB(12) "PROFILE POWER IN HOVER OGE";TAB(57) PO
990 LPRINT TAB(12) "TOTAL POWER IN HOVER OGE";TAB(57) PT
1000 LPRINT TAB(12) "FIGURE OF MERIT";TAB(57) FM(N-1)
1010 LPRINT TAB(12) "PERCENT INDUCED POWER";TAB(57)
PERINDP
1020 LPRINT TAB(12) "INDUCED POWER IN HOVER IGE";TAB(57)
PINI
1030 LPRINT TAB(12) "TOTAL POWER IN HOVER IGE";TAB(57) PTI
1040 LPRINT TAB(12) "EQUIVALENT FLAT PLATE AREA";TAB(57)
EFPA
1050 LCOPY:LPRINT CHR$ (12):RETURN 660
1060 '                  *** CHAPTER THREE SUBROUTINES ***
1070 '
1080 '
1090 '                         *** SECTION 3.1 ***
1100 '
1110 '
1120 TIPLOSS = 1 - (SQR(2*CT) / B)
1130 IF SGW>25000 THEN W1=GW1 ELSE W1=SGW
1140 PIN = (W1^1.5) / (SQR(2*RHO*PI*(R^2)) * TIPLOSS *
550)
1150 PO = (RHO*CDO*B*C*(R^4)*(OMEGA^3)) / (8 * 550)
1160 PT = PIN + PO
1170 HP = PT
1180 CLS:LOCATE 5,30,1:PRINT "*** SECTION 3.1 ***":LOCATE
7,16,1:PRINT "-FIRST ESTIMATE OF POWER REQUIRED TO HOVER
OGE-":LOCATE 9,26,1:PRINT "INDUCED POWER =";PIN:LOCATE
11,26,1:PRINT "PROFILE POWER =";PO
1190 LOCATE 13,26,1:PRINT "TOTAL POWER =";PT:GOSUB 60:IF
X=12 THEN GOTO 1200 ELSE RETURN 440
1200 '
1210 '
1220 '                         *** SECTION 3.2 ***
1230 '
1240 '
1250 A2=1:CLS:LOCATE 5,27,1:PRINT "*** SECTION 3.2 MENU
***":LOCATE 7,23,1:PRINT "-PRELIMINARY POWER CALCULATIONS-
":LOCATE 9,27,1:PRINT "*** WEIGHT CATEGORIES ***":LOCATE
12,17,1:PRINT "1.  LIGHT HELICOPTER LESS THAN 3000 lbs"
```

```
1260 LOCATE 14,17,1:PRINT "2.  MEDIUM HELICOPTER BETWEEN
3000 - 25,000 lbs":LOCATE 16,17,1:PRINT "3.  HEAVY
HELICOPTER GREATER THAN 25,000 lbs"
1270 LOCATE 23,26,1:INPUT "WHICH CATEGORY DO YOU
WANT";Y:CLS:LOCATE 10,15,1:INPUT "FROM HD-7 ESTIMATE FUEL
CAPACITY (LBS) AND ENTER";FUEL:LOCATE 12,15,1:INPUT "ENTER
NUMBER OF CREW AND OTHER
PERSONNEL";PEOPLE:N=1:PAX=PEOPLE*250
1280 LOCATE 14,15,1:INPUT "ENTER SPECIFICATION USEFUL
LOAD";UL:LOCATE 16,15,1:INPUT "ENTER WEIGHT OF ANY SPECIAL
AVIONICS EQUIPMENT";SPECIAL:LOCATE 18,15,1:INPUT "ENTER
ESTIMATE OF NUMBER OF ENGINES";ENGINE
1290 LOCATE 22,32,1:INPUT "ANY CHANGES (Y/N)";A$:IF A$="y"
THEN GOTO 1250 ELSE IF A$="Y" GOTO 1250 ELSE IF A$="n"
GOTO 1310 ELSE IF A$="N" GOTO 1310 ELSE
1300 LOCATE 23,27,1:PRINT "you must enter (y/n) try
again":LOCATE 22,50,1:PRINT "              ":GOTO 1290
1310 S = B*C*R:IF Y=1 THEN GW(1)=173.701*(WE^.378) ELSE IF
Y=2 THEN GW(1)=16239.43*LOG(WE)-130252.76# ELSE IF Y=3
THEN GW(1)=4.975*(WE^.887)
1320 IF Y=1 THEN GOSUB 3040 ELSE IF Y=2 THEN GOSUB 3370
ELSE IF Y=3 THEN GOSUB 3650
1330 A2=0:IF X=12 THEN GOTO 1540 ELSE RETURN 440
1340 '
1350 '
1360 '               *** PRINT WEIGHT ESTIMATION TABLE ***
1370 '
1380 '
1390 CLS:LOCATE 1,30,1:PRINT "WEIGHT ESTIMATION
TABLE":LOCATE 3,42,1:PRINT "------------ ITERATION -------
----":LOCATE 4,42,1:PRINT "FIRST         SECOND
THIRD":LOCATE 6,1,1:PRINT "1.  ROTOR:";TAB(41) W(1,1)
TAB(55) W(1,2) TAB(70) W(1,3)
1400 PRINT "2.  TAIL  ROTOR:";TAB(41) W2A(1) TAB(55)
W2A(2) TAB(70) W2A(3):PRINT "          STRUCTURE:";TAB(41)
W2B(1) TAB(55) W2B(2) TAB(70) W2B(3):PRINT "3.
BODY:";TAB(41) W(3,1) TAB(55) W(3,2) TAB(70) W(3,3)
1410 PRINT "4.  LANDING GEAR:";TAB(41) W(4,1) TAB(55)
W(4,2) TAB(70) W(4,3):PRINT "5.  NACELLE:";TAB(41) W(5,1)
TAB(55) W(5,2) TAB(70) W(5,3)
1420 PRINT "6.  PROPULSION ENGINE:";TAB(41) W6A(1) TAB(55)
W6A(2) TAB(70) W6A(3):PRINT TAB(16) "DRIVE:";TAB(41)
W6B(1) TAB(55) W6B(2) TAB(70) W6B(3):PRINT TAB(16) "FUEL
TANKS:";TAB(41) W6C(1) TAB(55) W6C(2)
1430 LOCATE 14,70,1:PRINT W6C(3):PRINT "7.  FLIGHT
CONTROLS:";TAB(41) W(7,1) TAB(55) W(7,2) TAB(70)
W(7,3):PRINT "8.  AUXILLARY POWER:";TAB(41) W(8,1) TAB(55)
W(8,2) TAB(70) W(8,3):PRINT "9.  INSTRUMENTS:";TAB(41)
W(9,1) TAB(55) W(9,2) TAB(70) W(9,3)
1440 PRINT "10. HYDRAULICS:";TAB(41) W(10,1) TAB(55)
W(10,2) TAB(70) W(10,3):PRINT "11. ELECTRICAL:";TAB(41)
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W(11,1) TAB(55) W(11,2) TAB(70) W(11,3):PRINT "12.
AVIONICS:";TAB(41) W(12,1) TAB(55) W(12,2) TAB(70)
W(12,3):PRINT "13. FURNISHINGS:"
1450 LOCATE 21,41,1:PRINT W(13,1) TAB(55) W(13,2) TAB(70)
W(13,3):PRINT "14. AIR & ICE:";TAB(41) W(14,1) TAB(55)
W(14,2) TAB(70) W(14,3):PRINT "15. LOAD &
HANDLING:";TAB(41) W(15,1) TAB(55) W(15,2) TAB(70) W(15,3)
1460 IF X=14 THEN GOTO 1470 ELSE IF X=15 THEN GOTO 1470
ELSE N=N+1
1470 IF X=14 THEN GOTO 1480 ELSE IF X=15 THEN GOTO 1480
ELSE IF N<1 THEN GOTO 1480 ELSE WE(N)=0:FOR I=1 TO
15:WE(N)=W(I,(N-1))+WE(N):NEXT I:GW(N)=WE(N)+UL+FUEL+PAX
1480 IF AP=1 THEN LCOPY:GOTO 1490 ELSE GOSUB 60
1490 CLS:LOCATE 10,15,1:PRINT "THE NEW MANUFACTURER'S
EMPTY WEIGHT =";WE(N):LOCATE 12;15,1:PRINT "THE NEW GROSS
WEIGHT =";GW(N):IF AP=1 THEN LCOPY:LPRINT CHR$ (12):RETURN
690 ELSE GOSUB 60
1500 IF AB=1 THEN RETURN 2510 ELSE IF AB=2 THEN RETURN
4060 ELSE IF A5=1 GOTO 2100 ELSE IF X=12 GOTO 1540 ELSE
RETURN 440
1510 '
1520 '
1530 '
1540 '                        *** SECTION 3.3 ***
1550 '
1560 '
1570 DL(N) = GW(N) / (PI*R^2)
1580 CLS:LOCATE 5,30,1:PRINT "*** SECTION 3.3 ***":LOCATE
7,28,1:PRINT "-VALIDATE DISC LOADING-"
1590 IF X7=1 THEN CLS:GOTO 1600 ELSE
1600 LOCATE 10,24,1:PRINT "THE NEW GROSS WEIGHT
OF:";GW(N):LOCATE 11,24,1:PRINT "HAS A DISC LOADING
OF:";DL(N):LOCATE 13,20,1:PRINT "ORIGINAL DISC LOADING
FROM FIGURE 2-2 ="DL
1610 LOCATE 16,20,1:INPUT "DO YOU WANT TO MAKE ANY
MODIFICATIONS (Y/N)";A$:IF A$="y" THEN GOTO 1630 ELSE IF
A$="Y" GOTO 1630 ELSE IF A$="n" GOTO 1700 ELSE IF A$="N"
GOTO 1700 ELSE
1620 LOCATE 24,25,1:INPUT "you must enter (y/n) try
again";C$:IF C$="y" THEN GOTO 1630 ELSE IF C$="Y" GOTO
1630 ELSE IF C$="n" GOTO 1700 ELSE IF C$="N" GOTO 1700
ELSE GOTO 1620
1630 CLS:LOCATE 10,10,1:INPUT "DO YOU WANT TO CHANGE DISC
LOADING";A$:IF A$="Y" THEN GOTO 1660 ELSE IF A$="y" GOTO
1660 ELSE
1640 IF A$="N" GOTO 1680 ELSE IF A$="n" GOTO 1680 ELSE
1650 LOCATE 23,27,1:PRINT "you must enter (y/n) try
again":GOTO 1630
1660 LOCATE 12,10,1:INPUT "ENTER NEW DISC LOADING";DL:GOTO
1700
```

```
1670 R=SQR(GW(N)/(DL*PI)):OMEGA=VTIPMAX/R:CT=GW(N)/(PI*
(R^2)*RHO*((OMEGA*R)^2)):SIGMA=CT/MBL:C=(SIGMA*PI*R)/B:AR=
R/C:CL=(CT*6)/SIGMA
1680 CLS:LOCATE 5,10,1:PRINT "THE NEW ROTOR RADIUS
IS:";R:LOCATE 8,10,1:PRINT "THE FOLLOWING VARIABLES HAVE
CHANGED TO THESE NEW VALUES:":LOCATE 10,10,1:PRINT
"ROTATIONAL VELOCITY =";OMEGA
1690 LOCATE 11,10,1:PRINT "THRUST COEFFICIENT =";CT:PRINT
TAB(10) "BLADE SOLIDITY =";SIGMA:PRINT TAB(10) "CHORD
=";C:PRINT TAB(10) "ASPECT RATIO =";AR:PRINT TAB(10) "LIFT
COEFFICIENT =";CL:GOSUB 60
1700 IF X7=1 THEN RETURN 2440 ELSE IF X=12 THEN GOTO 1730
ELSE RETURN 440
1710 '
1720 '
1730 '                       *** SECTION 3.4 ***
1740 '
1750 '
1760 BBBB=FRE("")
1770 E=1
1780 GOSUB 4010:GOSUB
4020:FM(N)=FM:WE4(0)=WE(N):GW4(0)=GW(N)
1790 CLS:GOSUB 3960:LOCATE 4,56,1:PRINT "OPTIONS":LOCATE
7,42,1:PRINT "1.  INCREASE LENGTH OF ROTOR CHORD":LOCATE
9,42,1:PRINT "2.  REDUCE ROTATIONAL VELOCITY":LOCATE
11,42,1:PRINT "3.  CHANGE ROTOR RADIUS":LOCATE
13,42,1:PRINT "4.  NO CHANGES"
1800 AZ=0:LOCATE 16,50,1:INPUT "SELECT OPTION";W:IF W=1
THEN GOTO 1860 ELSE IF W=2 GOTO 1870 ELSE IF W=3 GOTO 1880
ELSE IF W=4 GOTO 1820
1810 LOCATE 16,42,1:INPUT "number must be between 1-4 try
again";W:IF W=1 THEN GOTO 1860 ELSE IF W=2 GOTO 1870 ELSE
IF W=3 THEN GOTO 1880 ELSE IF W=4 GOTO 1820 ELSE GOTO 1810
1820 IF X7=1 THEN RETURN 2460 ELSE IF X=12 THEN GOTO 2060
ELSE RETURN 440
1830 IF X=7 THEN RETURN 2460 ELSE IF X=11 THEN GOTO 2060
ELSE RETURN 440
1840 AZA=1:N4=N:N=20:GW(N)=GW(N4):S=B*C*R:IF Y=1 THEN
GOSUB 3040 ELSE IF Y=2 THEN GOSUB 3370 ELSE IF Y=3 THEN
GOSUB 3650
1850 EE=EE+1:WE4(EE)=0:FOR I=1 TO 15:WE4(EE)=W(I,N)+
WE4(EE):NEXT
I:GW4(EE)=WE4(EE)+UL+FUEL+PAX:N=N4:AZA=0:RETURN
1860 LOCATE 20,45,1:INPUT "ENTER NEW BLADE CHORD
LENGTH";C:E=E+1:ZZ=1:ZA=0:GOSUB 240:GOSUB 4010:GOSUB
4020:GOSUB 1840:GOSUB 1890:GOTO 1920
1870 E=E+1:ZZ=1:ZA=1:GOSUB 130:GOSUB 4010:GOSUB 4020:GOSUB
1840:GOSUB 1890:GOTO 1920
1880 LOCATE 20,45,1:INPUT "ENTER NEW ROTOR
RADIUS";R:E=E+1:ZZ=1:ZA=0:GOSUB 240:GOSUB 4010:GOSUB
4020:GOSUB 1840:GOSUB 1890:GOTO 1920
```

```
1890 FOR I=7 TO 11:LOCATE I,25,1:PRINT "
":NEXT I:FOR I=15 TO 22:LOCATE I,25,1:PRINT "
":NEXT I
1900 LOCATE 7,25,1:PRINT PIN(1):LOCATE 8,25,1:PRINT
PO(1):LOCATE 9,25,1:PRINT PT(1):LOCATE 10,25,1:PRINT
FM:LOCATE 11,25,1:PRINT PERINDP:LOCATE 15,25,1:PRINT
WE4(EE):LOCATE 16,25,1:PRINT GW4(EE):LOCATE 17,25,1:PRINT
OMEGA:LOCATE 18,25,1:PRINT CT
1910 LOCATE 19,25,1:PRINT SIGMA:LOCATE 20,25,1:PRINT
R:LOCATE 21,25,1:PRINT C:LOCATE 22,25,1:PRINT AR:LOCATE
23,25,1:PRINT CL:RETURN
1920 FOR I=3 TO 23:LOCATE I,41,1:PRINT "
":NEXT I:LOCATE 4,56,1:PRINT "OPTIONS":LOCATE 7,42,1:PRINT
"1.  INCREASE LENGTH OF ROTOR CHORD":LOCATE 9,42,1:PRINT
"2.  REDUCE ROTATIONAL VELOCITY":LOCATE 11,42,1
1930 PRINT "3.  CHANGE ROTOR RADIUS":LOCATE 13,42,1:PRINT
"4.  LIST FIRST & LAST SET OF PARAMETERS":LOCATE
15,42,1:PRINT "5.  NO CHANGES":LOCATE 18,50,1:INPUT
"SELECT OPTION";W:IF W=1 THEN GOTO 1860 ELSE IF W=2 GOTO
1870 ELSE IF W=3 GOTO 1880 ELSE
1940 IF W=4 GOTO 1960 ELSE IF W=5 GOTO 1820 ELSE
1950 LOCATE 20,42,1:INPUT "number must be between 1-5 try
again";W:IF W=1 THEN GOTO 1860 ELSE IF W=2 GOTO 1870 ELSE
IF W=3 GOTO 1880 ELSE IF W=4 GOTO 1960 ELSE IF W=5 GOTO
440 ELSE GOTO 1950
1960 FOR I=3 TO 23:LOCATE I,41,1:PRINT "
":NEXT I
1970 NN=42:EE=1:FOR I=1 TO 2:IF I=1 THEN LOCATE
4,42,1:PRINT "ORIGINAL":LOCATE 5,42,1:PRINT "PARAMETERS"
ELSE LOCATE 4,60,1:PRINT "LAST SET OF":LOCATE 5,60,1:PRINT
"PARAMETERS"
1980 LOCATE 7,NN,1:PRINT PIN(EE):LOCATE 8,NN,1:PRINT
PO(EE):LOCATE 9,NN,1:PRINT PT(EE):LOCATE 10,NN,1:PRINT
FM(EE):LOCATE 11,NN,1:PRINT PERINDP(EE):LOCATE
15,NN,1:PRINT WE4(EE-1):LOCATE 16,NN,1:PRINT GW4(EE-
1):LOCATE 17,NN,1:PRINT OMEGA(EE)
1990 LOCATE 18,NN,1:PRINT CT(EE):LOCATE 19,NN,1:PRINT
SIGMA(EE):LOCATE 20,NN,1:PRINT R(EE):LOCATE 21,NN,1:PRINT
C(EE):LOCATE 22,NN,1:PRINT AR(EE):LOCATE 23,NN,1:PRINT
CL(EE):NN=60:EE=E-1:NEXT I:GOSUB 2000:GOTO 1920
2000 LOCATE 25,45,0:PRINT "** press any key to continue
**"
2010 A$=INKEY$:IF A$="" THEN 2000
2020 LOCATE 25,45,0:PRINT "
"
2030 RETURN
2040 '
2050 '
```

```
2060 '                    *** SECTION 3.5 ***
2070 '
2080 '
2090 IF Y=1 THEN A5=1:GOSUB 3040 ELSE IF Y=2 THEN
A5=1:GOSUB 3370 ELSE IF Y=3 THEN A5=1:GOSUB 3650
2100 AC=0:IF X=12 THEN GOTO 2120 ELSE RETURN 440
2110 '
2120 '
2130 '                  *** SECTION 3.6 ***
2140 '
2150 '
2160 CLS:LOCATE 2,30,1:PRINT "*** SECTION 3.6 ***":LOCATE
3,30,1:PRINT "-LANDING GEAR-":LOCATE 6,30,1:PRINT "LANDING
GEAR OPTIONS":LOCATE 9,25,1:PRINT "1.  SKIDS":LOCATE
11,25,1:PRINT "2.  FIXED LANDING GEAR"
2170 LOCATE 13,25,1:PRINT "3.  RETRACTABLE GEAR"
2180 LOCATE 16,28,1:INPUT "SELECT LANDING GEAR
OPTION";GR:IF GR=1 THEN GOTO 2190 ELSE IF GR=2 GOTO 2200
ELSE IF GR=3 GOTO 2210 ELSE LOCATE 18,24,1:PRINT "number
must be between 1-3 try again":LOCATE 16,55,1:PRINT "
":GOTO 2170
2190 AA=1:IF B=2 THEN FL=2 ELSE FL=4:GOTO 2220
2200 AA=2:IRLG = 1:LOCATE 20,30,1:INPUT "NUMBER OF LANDING
GEAR";NW:GOTO 2220
2210 AA=2:IRLG = 2:LOCATE 20,30,1:INPUT "NUMBER OF LANDING
GEAR";NW:GOTO 2220
2220 LOCATE 23,30,0:INPUT "ANY CHANGES (Y/N)";B$:IF B$="Y"
THEN GOTO 2160 ELSE IF B$="y" GOTO 2160 ELSE IF B$="N"
GOTO 2240 ELSE IF B$="n" GOTO 2240 ELSE
2230 LOCATE 25,27,0:PRINT "you must enter (y/n) try
again":GOTO 2220
2240 A5=0:IF X=12 THEN GOTO 2250 ELSE RETURN 440
2250 '
2260 '
2270 '                     *** SECTION 3.7 ***
2280 '
2290 '
2300 GOSUB 4010
2310 CLS:LOCATE 5,30,1:PRINT "*** SECTION 3.7 ***":LOCATE
7,16,1:PRINT "-THIRD ESTIMATE OF POWER REQUIRED TO HOVER
OGE-":LOCATE 9,26,1:PRINT "INDUCED POWER =";PIN:LOCATE
11,26,1:PRINT "PROFILE POWER =";PO
2320 LOCATE 13,26,1:PRINT "TOTAL POWER =";PT:GOSUB 60:IF
X=12 THEN GOTO 2360 ELSE RETURN 440
2330 '
2340 '
```

```
2350 '                         *** SECTION 3.8 ***
2360 '
2370 '
2380 BBBB=FRE("")
2390 A7=1:CLS:LOCATE 5,30,1:PRINT "*** SECTION 3.8
***":LOCATE 7,18,1:PRINT "-GROSS WEIGHT AND HOVER POWER
ITERATIONS-":PT(N)=PT:FM(N)=FM:LOCATE 10,4,1:PRINT "IF
DISC LOADING OR FIGURE OF MERIT EXCEED THEIR DEFINED LIMIT
THE PROGRAM"
2400 LOCATE 11,4,1:PRINT "WILL AUTOMATICALLY GO TO SECTION
3.3 OR 3.4 TO ALLOW CORRECTIONS AND RETURN":GOSUB
60:LOCATE 23,1,0:PRINT "~W=COMP/":N=N+1:GW(N)=GW(N-1)
2410 AZ=1:IF Y=1 THEN GOSUB 3040 ELSE IF Y=2 THEN GOSUB
3370 ELSE IF Y=3 THEN GOSUB 3650
2420 WE(N)=0:FOR I=1 TO 15:WE(N)=W(I,(N))+WE(N):NEXT
I:GW(N)=WE(N)+UL+FUEL+PAX
2430 GOSUB 4010:PT(N)=PT:FM(N)=FM:DL(N)=GW(N)/(PI*R^2):IF
DL(N)>DL THEN X7=1:GOSUB 1590
2440 IF FM(N)< .7 THEN GOSUB 1790 ELSE IF Y=3 THEN GOSUB
2450 ELSE IF FM(N)> .8 THEN GOSUB 1790 ELSE
2450 IF FM(N)>.85 THEN GOSUB 1790
2460 PERDIFW = (ABS(GW(N)-GW(N-1))/GW(N))*100:PERDIFP =
(ABS(PT(N)-PT(N-1))/PT(N))*100
2470 IF PERDIFW < 10 THEN GOTO 2480 ELSE GW(N)=GW(N-
1):GOTO 2410
2480 IF PERDIFP < 10 THEN GOTO 2490 ELSE GW(N)=GW(N-
1):GOTO 2410
2490 W(1,3)=W(1,N):W(2,3)=W(2,N):W2A(3)=W2A(N):W2B(3)=
W2B(N):W(3,3)=W(3,N):W(4,3)=W(4,N):W(5,3)=W(5,N):W(6,3)=W(
6,N):W6A(3)=W6A(N):W6B(3)=W6B(N):W6C(3)=W6C(N):W(7,3)=W(7,
N):W(8,3)=W(8,N):W(9,3)=W(9,N):W(10,3)=W(10,N):W(11,3)=W(1
1,N):W(12,3)=W(12,N)
2500 W(13,3)=W(13,N):W(14,3)=W(14,N):W(15,3)=W(15,N):AB=1:
GOSUB 1390
2510 A7=0:AB=0:CLS:LOCATE 10,20,1:PRINT "PERCENT
DIFFERENCE IN WEIGHT =";PERDIFW:LOCATE 12,20,1:PRINT
"PERCENT DIFFERENCE IN POWER =";PERDIFP:ITER=N-4:LOCATE
14,20,1:PRINT "NUMBER OF ITERATIONS =";ITER:GOSUB 60:IF
X=12 THEN GOTO 2540 ELSE RETURN 440
2520 '
2530 '
2540 '                     *** SECTION 3.9 ***
2550 '
2560 '
2570 CLS:LOCATE 2,30,2:PRINT "*** SECTION 3.9 ***":LOCATE
3,22,1:PRINT "-POWER REQUIRED TO HOVER IGE, SSL-":LOCATE
10,10,1:INPUT "FROM HD-7 ESTIMATE ROTOR HEIGHT ABOVE
GROUND AND ENTER";RH:H=RH+5:D=2*R
2580 PINI = ((-.1276*((H/D)^4) + .708*((H/D)^3) - 1.4569*
((H/D)^2) + 1.3432*(H/D) + .5147) * PIN):PTI=PINI+PO
```

```
2590 LOCATE 14,18,1:PRINT "INDUCED POWER REQUIRED TO HOVER
IGE =";PINI:LOCATE 16,18,1:PRINT "TOTAL POWER REQUIRED TO
HOVER IGE =";PTI:GOSUB 60:IF X=12 THEN GOTO 2620 ELSE
RETURN 440
2600 '
2610 '
2620 '                    *** SECTION 3.10 ***
2630 '
2640 '
2650 CLS:LOCATE 2,30,1:PRINT "*** SECTION 3.10 ***":LOCATE
3,20,2:PRINT "-EQUIVALENT FLAT PLATE AREA (HORIZONTAL)-
":LOCATE 8,30,1:PRINT "TABLE III OPTIONS":LOCATE
10,32,1:PRINT "1.  OBSERVER":LOCATE 11,32,1:PRINT "2.
ATTACK I"
2660 LOCATE 12,32,1:PRINT "3.  ATTACK II":LOCATE
13,32,1:PRINT "4.  UTILITY I":LOCATE 14,32,1:PRINT "5.
UTILITY II":LOCATE 15,32,1:PRINT "6.  TRANSPORT":LOCATE
18,26,1:INPUT "WHICH MISSION DO YOU WANT";M
2670 IF M=1 THEN GOTO 2680 ELSE IF M=2 GOTO 2690 ELSE IF
M=3 THEN EFPA=34.98:GOTO 2730 ELSE IF M=4 GOTO 2700 ELSE
IF M=5 THEN EFPA=27.81625:GOTO 2730 ELSE IF M=6 GOTO 2710
2680 IF GR>1 THEN EFPA=13.122:GOTO 2730 ELSE
EFPA=12.15:GOTO 2730
2690 IF GR>2 THEN EFPA=20.0448:GOTO 2730 ELSE
EFPA=20.88:GOTO 2730
2700 IF GR>2 THEN EFPA=19.2576:GOTO 2730 ELSE
EFPA=20.06:GOTO 2730
2710 LOCATE 20,20,1:INPUT "IS THE FUSELAGE NOSE SHAPE
ROUND OR STREAMLINE (R/S)";A$:IF A$="R" THEN
EFPA=48.3181:GOTO 2730 ELSE IF A$="r" THEN
EFPA=48.3181:GOTO 2730 ELSE IF A$="S" THEN
EFPA=46.33785:GOTO 2730 ELSE IF A$="s" THEN EFPA=46.33785
2720 GOTO 2730 ELSE LOCATE 24,25,1:PRINT "you must enter
(R/S) try again":GOTO 2710
2730 LOCATE 22,23,1:PRINT "EQUIVALENT FLAT PLATE AREA
=";EFPA:GOSUB 60:IF X=12 THEN GOTO 2760 ELSE RETURN 440
2740 '
2750 '
2760 '                    *** SECTION 3.11 ***
2770 '
2780 '
2790 BBB=FRE("")
2800 CLS:LOCATE 2,30,1:PRINT "*** SECTION 3.11 ***":LOCATE
3,20,1:PRINT "-TOTAL POWER REQUIRED AND TIP MACH NUMBER-
":RHO(1)=RHO:M(1)=1116.89
2810 LOCATE 10,23,1:INPUT "ENTER SPECIFICATION CRUISE
SPEED";CRUISEV:LOCATE 12,23,1:INPUT "ENTER SPECIFICATION
ALTITUDE";ALT:LOCATE 14,23,1:INPUT "ENTER SPECIFICATION
TEMPERATURE";TEMP
```

```
2820 LOCATE 23,32,2:INPUT "ANY CHANGES (Y/N)";A$:IF A$="Y"
THEN GOTO 2800 ELSE IF A$="y" GOTO 2800 ELSE IF A$="N"
GOTO 2840 ELSE IF A$="n" GOTO 2840 ELSE
2830 LOCATE 24,27,1:PRINT "you must enter (y/n) try
again":LOCATE 23,50,1:PRINT "       ":GOTO 2820
2840 LOCATE 23,32,1:PRINT "
":LOCATE 23,1,0:PRINT "~W=COMP/"
2850 M(2)=SQR(2400.82388#*(459.688+TEMP)):RHO(2)=RHO(1)*
((1-(6.87535)*(10^-6)*ALT)^5.2561)*518.688/(459.688+TEMP)
:CRU=CRUISEV:CRU1=CRU/20:CRU2=FIX(CRU1)+1:MAXF=MAXFVEL:MAX
F1=MAXF/20:MAXF2=FIX(MAXF1)+1:MAXCRU=(MAXF-CRU)/20
2860 MAXCRU1=FIX(MAXCRU):FOR I=1 TO 2:J=0:LL=1:FOR K=1 TO
CRU2:GOSUB 3000:J=J+20:LL=LL+1:NEXT K,I:J(1)=J:IF
CRU1=FIX(CRU1) THEN CRU3=CRU2:GOTO 2870 ELSE FOR I=1 TO
2:CRU3=CRU2+1:J=CRU:GOSUB 3000:NEXT I:LL=LL+1:L1=LL:L2=LL-
1
2870 IF MAXCRU1=>1 THEN J=J(1):GOSUB 3020
2880 IF MAXF1=FIX(MAXF1) THEN MAXF3=MAXF2:J=J(1):GOTO 3020
ELSE
2890 FOR I=1 TO 2:MAXF3=MAXF2+1:J=MAXF:GOSUB 3000:NEXT I
2900 LL=LL+1:FOR I=1 TO 2:J=MAXF+20:GOSUB 3000:NEXT
I:LL=LL-1
2910 FOR KK=1 TO 2:GOSUB 2920:NEXT KK:IF AB=2 THEN RETURN
4060 ELSE IF AP=1 THEN LPRINT CHR$ (12):RETURN 690 ELSE
GOTO 440
2920 CLS:LOCATE 2,33,1:PRINT "MAIN ROTOR POWER"
2930 IF KK=1 THEN LOCATE 4,32,1:PRINT "STANDARD SEA
LEVEL":LOCATE 5,20,1:PRINT "ALTITUDE= 0 FT     TEMPERATURE
= 59 DEG. F" ELSE
2940 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F"
2950 LOCATE 7,29,1:PRINT "----------------- POWER --------
----------":LOCATE 9,8,1:PRINT "AIRSPEED     TIP
INDUCED     PROFILE     PARASITE     TOTAL"
2960 LOCATE 10,9,1:PRINT "(knots)    MACH      (SHP)
(SHP)       (SHP)       (SHP)"
2970 A$="###.#":B$="#.###":C$="####.##":K=12:I=0:FOR L=1
TO LL:LOCATE K,9,1:PRINT USING A$;O(L):LOCATE K,19,1:PRINT
USING B$;TM(KK,L):LOCATE K,29,1:PRINT USING
C$;PINF(KK,L):LOCATE K,41,1:PRINT USING
C$;POF(KK,L):LOCATE K,53,1:PRINT USING C$;PPF(KK,L)
2980 LOCATE K,65,1:PRINT USING C$;PTF(KK,L):K=K+1:NEXT L
2990 IF AP=1 THEN LCOPY:RETURN ELSE GOSUB 60:RETURN
3000 CT=GW(N)/(PI*R^4*RHO(I)*OMEGA^2):TIPLOSS=1-
(SQR(2*CT)/B):O(LL)=J:DA=(PI*R^2):VF=J*1.687778:VH2=GW(N)/
(2*RHO(I)*DA):MU1=VF/(OMEGA*R):PINF(I,LL)=(GW(N)*SQR(((VF^
2)/(-
VH2*2))+SQR(((VF^2)/(2*VH2))^2+1))*SQR(VH2))/(550*TIPLOSS)
:A(GG)=J:B(GG)=PINF(I,LL)
```

```
3010 POF(I,LL)=((SIGMA*CDO*RHO(I)*DA*((OMEGA*R)^3)*(1+4.3*
(MU1^2)))/4400):PPF(I,LL)=(RHO(I)*(VF^3)*EFPA)/1100:PTF(I,
LL)=PINF(I,LL)+POF(I,LL)+PPF(I,LL):TM(I,LL)=((OMEGA*R)+VF)
/M(I):RETURN
3020 IF MAXCRU1>1 AND MAXCRU1=MAXCRU THEN
MC=CINT(MAXCRU1/2) ELSE IF MAXCRU1>1 THEN
MC=CINT(MAXCRU1/2)+1 ELSE IF MAXCRU1=MAXCRU THEN MC=0 ELSE
MC=MAXCRU1
3030 L1=LL:FOR I=1 TO 2:J=J(1):LL=L1:FOR K=1 TO MC:GOSUB
3000:J=J+20:LL=LL+1:NEXT K,I:L3=LL:GOTO 2890
3040 '
3050 '
3060 '           *** WEIGHT ESTIMATING RELATIONSHIPS ***
3070 '
3080 '
3090 '                 ***  LIGHT HELICOPTER  ***
3100 '
3110 '
3120 STT = .264 * EXP(.0135*HP)
3130 SB = 194.274 * LOG(GW(N)) - 1306.779
3140 '
3150 '
3160 W(1,N) = 408.562 * LOG(S) - 1142.917
3170 W2A(N) = 2.219 * EXP(.0005*GW(N))
3180 W2B(N) = 19.131 * LOG(STT) - 32.414:W(2,N)=W2A(N)+
W2B(N)
3190 W(3,N) = .00901 * SB^1.917
3200 IF AA=1 THEN W(4,N) = .0245*(GW(N)^.8606)*(FL^.8046)
ELSE W(4,N) = -.0539 * GW(N) + 200.912
3210 W(5,N) = 34
3220 W6A(N) = -8.959999E-02 * HP + 221.338
3230 W6B(N) = 17.19 * EXP(.0008*GW(N))
3240 W6C(N) = .384 * (FUEL/6.5)^1.071:W(6,N)=W6A(N)+W6B(N)
+W6C(N)
3250 W(7,N) = 1.28E-10*(GW(N)^3.469)
3260 W(8,N) = 0
3270 W(9,N) = 24.571 * EXP(.0004*HP)
3280 W(10,N) = 0
3290 W(11,N) = -51.0661 * LOG(SB) + 367.947
3300 W(12,N) = 105 + SPECIAL
3310 W(13,N) = 19.8 * (EXP(.372*PEOPLE) + EXP(-.033*SB))
3320 W(14,N) = -22.371 * LOG(SB) + 143.396
3330 W(15,N) = 0
3340 IF AZ=1 THEN RETURN 2420 ELSE IF AZA=1 THEN RETURN
1850 ELSE RETURN 1390
3350 '
3360 '
```

```
3370 '                    ***  MEDIUM HELICOPTER  ***
3380 '
3390 '
3400 STT = .0376 * HP - 8.106
3410 SB = 636.081 * EXP(.000011*GW(N))
3420 '
3430 '
3440 W(1,N) = 11.0702 * S -168.888
3450 W2A(N) = .00438 * GW(N) + 12.47
3460 W2B(N) = 2.411 * STT - 19.531:W(2,N) = W2A(N)+W2B(N)
3470 W(3,N) = .282 * SB^1.272
3480 IF AA=1 THEN W(4,N)=.0245*((GW(N))^.8606)*(FL^.8046)
ELSE IF AA=2 THEN W(4,N) = .4013*(GW(N)^.6662)*(NW^.536)*
(IRLG^.1198) ELSE IF GW(N)>6000 THEN W(4,N) = 301.577 *
LOG(GW(N)) - 2319.89 ELSE W(4,N) = .025 * EXP(.000062 *
GW(N) + 8.020001)
3490 W(5,N) = .02 * EXP(.000062 * GW(N) + 8.020001)
3500 IF ENGINE=1 THEN W6A(N) = 130 + .24 * HP ELSE W6A(N)
= 350.4 + .19 * HP
3510 W6B(N) = 741.46 * LOG(HP) - 4542.042
3520 W6C(N) = 363.24 * LOG(FUEL/6.5) - 1656.521:W(6,N)=
W6A(N)+W6B(N)+W6C(N)
3530 W(7,N) = 210.858 * EXP(.000059 * GW(N))
3540 IF ENGINES=1 THEN W(8,N) = 0 ELSE W(8,N) = 190
3550 W(9,N) = 56.0975 * LOG(HP) - 312.237
3560 W(10,N) = .00362 * GW(N) + 11.553
3570 W(11,N) = 481.735 * LOG(SB) - 2794.53
3580 W(12,N) = 250 + SPECIAL
3590 W(13,N) = .175 * SB + 22 * PEOPLE - 10
3600 W(14,N) = 122.458 * LOG(SB) -730.252
3610 W(15,N) = 84.5
3620 IF AZ=1 THEN RETURN 2420 ELSE IF AZA=1 THEN RETURN
1850 ELSE RETURN 1390
3630 '
3640 '
3650 '
3660 '
3670 '
3680 '                    ***  HEAVY HELICOPTER  ***
3690 '
3700 '
3710 STT = 60.127 * EXP(.000145*HP)
3720 SB = 426.378 * EXP(.000045*GW(N))
3730 '
3740 '
3750 W(1,N) = 707.174 * EXP(.00539*B*C*R)
3760 W2A(N) = 324.55 * LOG(GW(N)) - 3021.51
3770 W2B(N) = -18! + 2.83 * STT:W(2,N)=W2A(N)+W2B(N)
3780 W(3,N) = 2.9818 * SB - 1321.921
3790 IF AA=2 THEN W(4,N) = .4013*(GW(N)^.6662)*(NW^.536)
*(IRLG^.1198) ELSE W(4,N) = 258.358 * EXP(.000041 * GW(N))
```

```
3800 W(5,N) = .014 * (.2041 * GW(N))^1.136
3810 W6A(N) = 348 + .91 *HP
3820 W6B(N) = .999 * HP^.959
3830 W6C(N) = 454.619 * (FUEL/6.5)^(-.0566):W(6,N)=
W6A(N)+W6B(N)+W6C(N)
3840 W(7,N) = .00334 * GW(N)^1.224
3850 W(8,N) = 139
3860 W(9,N) = 68.266 * LOG(HP) - 387.598
3870 W(10,N) = 6.63E-07 * GW(N)^1.863
3880 W(11,N) = 9.78 * SB^.539
3890 W(12,N) = 325 + SPECIAL
3900 W(13,N) = .159 * SB + 18.11 * PEOPLE
3910 W(14,N) = 117.771 * LOG(SB) - 710.594
3920 W(15,N) = -72 + .111*SB + 3.49 * PEOPLE
3930 IF AZ=1 THEN RETURN 2420 ELSE IF AZA=1 THEN RETURN
1850 ELSE RETURN 1390
3940 '
3950 '
3960 CLS:LOCATE 3,1,1:FOR I=1 TO 21:PRINT TAB(40) "°":NEXT
I:FOR I=1 TO 39:LOCATE 13,I,1:PRINT "-":NEXT I
3970 LOCATE 2,31,1:PRINT "*** SECTION 3.4 ***":LOCATE
4,26,1:PRINT "CURRENT":LOCATE 5,25,1:PRINT
"PARAMETERS":LOCATE 7,2,1:PRINT "INDUCED POWER:";TAB(25)
PIN:PRINT TAB(2) "PROFILE POWER:";TAB(25) PO:PRINT TAB(2)
"TOTAL POWER:";TAB(25) PT
3980 PRINT TAB(2) "FIGURE OF MERIT:";TAB(25) FM:PRINT
TAB(2) "% INDUCED POWER:";TAB(25) PERINDP:LOCATE
15,2,1:PRINT "EMPTY WEIGHT";TAB(25) WE(N):PRINT TAB(2)
"GROSS WEIGHT";TAB(25) GW(N):PRINT TAB(2) "ROTATIONAL
VELOCITY:";TAB(25) OMEGA
3990 PRINT TAB(2) "THRUST COEFFICIENT";TAB(25) CT:PRINT
TAB(2) "BLADE SOLIDITY:";TAB(25) SIGMA:PRINT TAB(2) "ROTOR
RADIUS";TAB(25) R:PRINT TAB(2) "CHORD";TAB(25) C:PRINT
TAB(2) "ASPECT RATIO";TAB(25) AR:PRINT TAB(2) "COEFFICIENT
OF LIFT:";TAB(25) CL
4000 RETURN
4010 CT=GW(N)/(PI*R^4*RHO*OMEGA^2):TIPLOSS=1-
(SQR(2*CT)/B):
PIN=(GW(N)^1.5)/(SQR(2*RHO*PI*(R^2))*TIPLOSS*550):PO=(RHO*
CDO*B*C*(R^4)*(OMEGA^3))/(8*550):PT=PIN+PO:HP=PT:PINWOTL=P
IN*TIPLOSS:FM=PINWOTL/PT:PERINDP=(PIN/PT)*100:S=B*C*R:RETU
RN
4020 PIN(E)=PIN:PO(E)=PO:PT(E)=PT:FM(E)=FM:PERINDP(E)=
PERINDP:OMEGA(E)=OMEGA:CT(E)=CT:SIGMA(E)=SIGMA:R(E)=R:C(E)
=C:AR(E)=AR:CL(E)=CL:RETURN
4030 PIN=PIN(E):PO=PO(E):PT=PT(E):FM=FM(E):PERINDP=
PERINDP(E):OMEGA=OMEGA(E):CT=CT(E):SIGMA=SIGMA(E):R=R(E):C
=C(E):AR=AR(E):CL=CL(E):RETURN
4040 IF 65535!=ERL THEN GOTO 4050 ELSE RESUME
4050 IF ZZ=1 THEN LOCATE 23,45,1:PRINT "MUST BE A
NUMBER":LOCATE 24,45,1:INPUT "TRY AGAIN";W:RESUME ELSE
```

```
LOCATE 24,20,1:PRINT "ENTRY MUST BE A NUMBER TRY
AGAIN":RESUME
4060 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C3RESULT/":INPUT;"",RE:COLOR 15,1,1
4070 IF RE=1 THEN GOTO 4080 ELSE IF RE=2 THEN AB=2:GOSUB
1390 ELSE IF RE=3 THEN AB=2:GOSUB 2910 ELSE IF RE=4 THEN
GOTO 440
4080 CLS:LOCATE 2,25,1:PRINT "TABLE OF CHAPTER THREE
RESULTS"
4090 LOCATE 5,5,1:PRINT "SPECIFICATION GROSS
WEIGHT";TAB(50) SGW
4100 PRINT TAB(5) "ROUGH ESTIMATE GROSS WEIGHT";TAB(50)
GW1
4110 PRINT TAB(5) "ESTIMATE OF MANUFACTURER'S EMPTY
WEIGHT";TAB(50) WE
4120 PRINT TAB(5) "MAXIMUM TIP VELOCITY";TAB(50) VTIPMAX
4130 PRINT TAB(5) "ROTOR RADIUS";TAB(50) R
4140 PRINT TAB(5) "ROTATIONAL VELOCITY";TAB(50) OMEGA
4150 PRINT TAB(5) "BLADE SOLIDITY";TAB(50) SIGMA
4160 PRINT TAB(5) "NUMBER OF MAIN ROTOR BLADES";TAB(50) B
4170 PRINT TAB(5) "BLADE CHORD";TAB(50) C
4180 PRINT TAB(5) "BLADE ASPECT RATIO";TAB(50) AR
4190 PRINT TAB(5) "AVERAGE LIFT COEFFICIENT";TAB(50) CL
4200 PRINT TAB(5) "BLADE LIFT CURVE SLOPE";TAB(50) CLALPHA
4210 PRINT TAB(5) "BLADE DRAG COEFFICIENT";TAB(50) CDO
4220 PRINT TAB(5) "DISC LOADING";TAB(50) DL(N-1)
4230 PRINT TAB(5) "MAXIMUM ADVANCE RATIO";TAB(50) MU
4240 PRINT TAB(5) "MAXIMUM BLADE LOADING";TAB(50) MBL
4250 PRINT TAB(5) "MAXIMUM FORWARD VELOCITY";TAB(50)
MAXFVEL
4260 GOSUB 60
4270 CLS:LOCATE 5,5,1:PRINT "TIPLOSS";TAB(50) TIPLOSS
4280 PRINT TAB(5) "INDUCED POWER IN HOVER OGE";TAB(50) PIN
4290 PRINT TAB(5) "PROFILE POWER IN HOVER OGE";TAB(50) PO
4300 PRINT TAB(5) "TOTAL POWER IN HOVER OGE";TAB(50) PT
4310 PRINT TAB(5) "FIGURE OF MERIT";TAB(50) FM(N-1)
4320 PRINT TAB(5) "PERCENT INDUCED POWER";TAB(50) PERINDP
4330 PRINT TAB(5) "INDUCED POWER IN HOVER IGE";TAB(50)
PINI
4340 PRINT TAB(5) "TOTAL POWER IN HOVER IGE";TAB(50) PTI
4350 PRINT TAB(5) "EQUIVALENT FLAT PLATE AREA";TAB(50)
EFPA
4360 GOSUB 60:RETURN 4060
4370 '
4380 '
4390 '                        *** DATA INPUT ***
4400 '
4410 '
4420 '
4430 COLOR 1,1,1:CLS:PRINT "~W=INPUT/":INPUT;"",WW:COLOR
15,1,1
```

```
4440 IF WW=1 THEN GOTO 4460 ELSE IF WW=2 GOTO 4870 ELSE IF
WW=3 GOTO 5050 ELSE IF WW=4 THEN RETURN 440
4450 '
4460 CLS:LOCATE 1,28,1:PRINT "CHAPTER THREE DATA ENTRY"
4470 LOCATE 3,5,1:PRINT " 1.  SPECIFICATION GROSS WEIGHT"
4480 PRINT TAB(5) " 2.  ROUGH ESTIMATE GROSS WEIGHT"
4490 PRINT TAB(5) " 3.  ESTIMATE OF MANUFACTURER'S EMPTY
WEIGHT"
4500 PRINT TAB(5) " 4.  MAXIMUM TIP VELOCITY"
4510 PRINT TAB(5) " 5.  ROTOR RADIUS"
4520 PRINT TAB(5) " 6.  ROTATIONAL VELOCITY"
4530 PRINT TAB(5) " 7.  THRUST COEFFICIENT"
4540 PRINT TAB(5) " 8.  BLADE SOLIDITY"
4550 PRINT TAB(5) " 9.  NUMBER OF MAIN ROTOR BLADES"
4560 PRINT TAB(5) "10.  BLADE CHORD"
4570 PRINT TAB(5) "11.  BLADE ASPECT RATIO"
4580 PRINT TAB(5) "12.  AVERAGE LIFT COEFFICIENT"
4590 PRINT TAB(5) "13.  BLADE LIFT CURVE SLOPE"
4600 PRINT TAB(5) "14.  BLADE DRAG COEFFICIENT"
4610 PRINT TAB(5) "15.  DISC LOADING"
4620 PRINT TAB(5) "16.  MAXIMUM ADVANCE RATIO"
4630 PRINT TAB(5) "17.  MAXIMUM BLADE LOADING"
4640 PRINT TAB(5) "18.  MAXIMUM FORWARD VELOCITY"
4650 PRINT TAB(5) "19.  NEXT PAGE"
4660 GOTO 4770
4670 CLS:LOCATE 5,5,1:PRINT "20.  TIPLOSS"
4680 PRINT TAB(5) "21.  INDUCED POWER IN HOVER OGE"
4690 PRINT TAB(5) "22.  PROFILE POWER IN HOVER OGE"
4700 PRINT TAB(5) "23.  TOTAL POWER IN HOVER OGE"
4710 PRINT TAB(5) "24.  FIGURE OF MERIT"
4720 PRINT TAB(5) "25.  PERCENT INDUCED POWER"
4730 PRINT TAB(5) "26.  INDUCED POWER IN HOVER IGE"
4740 PRINT TAB(5) "27.  TOTAL POWER IN HOVER IGE"
4750 PRINT TAB(5) "28.  RETURN TO DATA INPUT MENU"
4760 GOTO 4770
4770 LOCATE 23,26,1:INPUT "WHICH DO YOU WANT TO
ENTER";X:IF X=1 THEN LOCATE 3,55,1:INPUT SGW:LOCATE
23,54,1:PRINT " ":GOTO 4770 ELSE IF X=2 THEN LOCATE
4,55,1:INPUT GW1:LOCATE 23,54,1:PRINT " ":GOTO 4770 ELSE
4780 IF X=3 THEN LOCATE 5,55,1:INPUT WE:LOCATE
23,54,1:PRINT " ":GOTO 4770 ELSE IF X=4 THEN LOCATE
6,55,1:INPUT VTIPMAX:LOCATE 23,54,1:PRINT " ":GOTO 4770
ELSE IF X=5 THEN LOCATE 7,55,1:INPUT R:LOCATE
23,54,1:PRINT " ":GOTO 4770 ELSE
4790 IF X=6 THEN LOCATE 8,55,1:INPUT OMEGA:LOCATE
23,54,1:PRINT " ":GOTO 4770 ELSE IF X=7 THEN LOCATE
9,55,1:INPUT CT:LOCATE 23,54,1:PRINT " ":GOTO 4770 ELSE IF
X=8 THEN LOCATE 10,55,1:INPUT SIGMA:LOCATE 23,54,1:PRINT "
":GOTO 4770 ELSE
4800 IF X=9 THEN LOCATE 11,55,1:INPUT B:LOCATE
23,54,1:PRINT " ":GOTO 4770 ELSE IF X=10 THEN LOCATE
```

```
12,55,1:INPUT C:LOCATE 23,54,1:PRINT "  ":GOTO 4770 ELSE
IF X=11 THEN LOCATE 13,55,1:INPUT AR:LOCATE 23,54,1:PRINT
"  ":GOTO 4770 ELSE
4810 IF X=12 THEN LOCATE 14,55,1:INPUT CL:LOCATE
23,54,1:PRINT "  ":GOTO 4770 ELSE IF X=13 THEN LOCATE
15,55,1:INPUT CLALPHA:LOCATE 23,54,1:PRINT "  ":GOTO 4770
ELSE
4820 IF X=14 THEN LOCATE 16,55,1:INPUT CDO:LOCATE
23,54,1:PRINT "  ":GOTO 4770 ELSE IF X=15 THEN LOCATE
17,55,1:INPUT DL:LOCATE 23,54,1:PRINT "  ":GOTO 4770 ELSE
IF X=16 THEN LOCATE 18,55,1:INPUT MU:LOCATE 23,54,1:PRINT
"  ":GOTO 4770 ELSE
4830 IF X=17 THEN LOCATE 19,55,1:INPUT MBL:LOCATE
23,54,1:PRINT "  ":GOTO 4770 ELSE IF X=18 THEN LOCATE
20,55,1:INPUT MAXFVEL:LOCATE 23,54,1:PRINT "  ":GOTO 4770
ELSE IF X=19 GOTO 4670 ELSE
4840 IF X=20 THEN LOCATE 5,55,1:INPUT PIN:LOCATE
23,54,1:PRINT "  ":GOTO 4770 ELSE IF X=21 THEN LOCATE
6,55,1:INPUT PIN:LOCATE 23,54,1:PRINT "  ":GOTO 4770 ELSE
IF X=22 THEN LOCATE 7,55,1:INPUT PO:LOCATE 23,54,1:PRINT "
":GOTO 4770 ELSE
4850 IF X=23 THEN LOCATE 8,55,1:INPUT PT:LOCATE
23,54,1:PRINT "  ":GOTO 4770 ELSE IF X=24 THEN LOCATE
9,55,1:INPUT FM:LOCATE 23,54,1:PRINT "  ":GOTO 4770 ELSE
IF X=25 THEN LOCATE 10,55,1:INPUT PERINDP:LOCATE
23,54,1:PRINT "  ":GOTO 4770 ELSE
4860 IF X=26 THEN LOCATE 11,55,1:INPUT PINI:LOCATE
23,54,1:PRINT "  ":GOTO 4770 ELSE IF X=27 THEN LOCATE
12,55,1:INPUT PTI:LOCATE 23,54,1:PRINT "  ":GOTO 4770 ELSE
IF X=28 THEN GOTO 4370
4870 CLS:LOCATE 1,30,1:PRINT "WEIGHT ESTIMATION
TABLE":LOCATE 2,42,1:PRINT "------------ ITERATION -------
----":LOCATE 3,42,1:PRINT "FIRST         SECOND
THIRD":LOCATE 4,1,1:PRINT "1.  ROTOR:"
4880 PRINT "2.  TAIL  ROTOR:":PRINT "
STRUCTURE:":PRINT "3.  BODY:":PRINT "4.  LANDING
GEAR:":PRINT "5.  NACELLE:"
4890 PRINT "6.  PROPULSION ENGINE:":PRINT TAB(16)
"DRIVE:":PRINT TAB(16) "FUEL TANKS:"
4900 PRINT "7.  FLIGHT CONTROLS:":PRINT "8.  AUXILLARY
POWER:":PRINT "9.  INSTRUMENTS:"
4910 PRINT "10. HYDRAULICS:":PRINT "11. ELECTRICAL:":PRINT
"12. AVIONICS:":PRINT "13. FURNISHINGS:"
4920 PRINT "14. AIR & ICE:":PRINT "15. LOAD &
HANDLING:":PRINT "16. EXIT TO DATA INPUT MENU"
4930 LOCATE 23,15,1:INPUT "COMPONENT NUMBER";I:IF I<1 THEN
GOTO 5030 ELSE IF I>16 GOTO 5030 ELSE IF I=16 THEN GOTO
4420 ELSE LOCATE 23,40,1:INPUT "WHICH ITERATION";N2:IF
N2<1 THEN GOTO 5030 ELSE IF N2>3 GOTO 5030 ELSE
4940 A$="A":IF I=2 THEN LOCATE 23,64,1:INPUT "R OR S";A$
ELSE IF I=6 THEN LOCATE 23,64,1:INPUT "E,D OR F";A$
```

```
4950 IF A$<"A" THEN GOTO 5030 ELSE IF A$>"S" GOTO 5030
4960 I2=0:I3=0:IF A$="R" THEN I2=0 ELSE IF A$="r" THEN
I2=0 ELSE IF A$="S" THEN I2=1 ELSE IF A$="s" THEN I2=1
ELSE IF A$="E" THEN I2=0 ELSE IF A$="e" THEN I2=0 ELSE IF
A$="D" THEN I2=1 ELSE IF A$="d" THEN I2=1 ELSE IF A$="F"
THEN I2=2 ELSE IF A$="f" THEN
4970 IF A$="f" THEN I2=2
4980 IF I<3 THEN I3=3 ELSE IF I<7 THEN I3=4 ELSE I3=6
4990 I1=I+I2+I3:IF N2=1 THEN LOCATE I1,40,1 ELSE IF N2=2
THEN LOCATE I1,54,1 ELSE IF N2=3 THEN LOCATE I1,69,1
5000 IF A$="R" THEN INPUT W2A(N2) ELSE IF A$="S" THEN
INPUT W2B(N2) ELSE IF A$="E" THEN INPUT W6A(N2) ELSE IF
A$="D" THEN INPUT W6B(N2) ELSE IF A$="F" THEN INPUT
W6C(N2) ELSE INPUT W(I,N2)
5010 LOCATE 23,32,1:PRINT "     ":LOCATE 23,57,1:PRINT "
"
5020 GOTO 4930
5030 LOCATE 25,20,1:PRINT "your input is not within range
try again":FOR I=1 TO 2500:NEXT I:LOCATE 23,32,1:PRINT "
":LOCATE 23,57,1:PRINT "                     ":LOCATE
25,20,1:PRINT "
"
5040 GOTO 4930
5050 CLS:LOCATE 10,10,1:INPUT "ENTER THEN NUMBER OF
AIRSPEEDS YOU HAVE CALCULATIONS FOR";LL:LOCATE
12,10,1:PRINT "IF YOU DO NOT HAVE AN ENTRY FOR A TABLE
ITEM JUST HIT THE ENTER KEY":LOCATE 13,10,1:PRINT "AND THE
CURSOR WILL MOVE TO THE NEXT ENTRY POINT"
5060 GOSUB 60:KK=1:GOTO 5110
5070 CLS:LOCATE 10,15,1:INPUT "DO YOU HAVE ANY ENTRIES FOR
SPECIFICATION ALTITUDE(Y/N)";B$:IF B$="Y" THEN GOTO 5090
ELSE IF B$="y" GOTO 5090 ELSE IF B$="N" GOTO GOTO 4420
ELSE IF B$="n" GOTO 4420 ELSE
5080 LOCATE 23,27,1:PRINT "you must enter (y/n) try
again":GOTO 5070
5090 LOCATE 12,15,1:INPUT "ENTER SPECIFICATION
ALTITUDE";ALT:LOCATE 14,15,1:INPUT "ENTER SPECIFICATION
TEMPERATURE";TEMP:LOCATE 16,15,1:INPUT "ENTER NUMBER OF
AIRSPEEDS YOU HAVE CALCULATIONS FOR";LL:KK=2:GOTO 5110
5100 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F"
5110 CLS:LOCATE 2,33,1:PRINT "MAIN ROTOR POWER"
5120 IF KK=1 THEN LOCATE 4,32,1:PRINT "STANDARD SEA
LEVEL":LOCATE 5,20,1:PRINT "ALTITUDE= 0 FT     TEMPERATURE
= 59 DEG. F" ELSE
5130 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F"
```

```
5140 LOCATE 7,29,1:PRINT "----------------- POWER --------
----------":LOCATE 9,8,1:PRINT "AIRSPEED     TIP
INDUCED     PROFILE     PARASITE     TOTAL"
5150 LOCATE 10,9,1:PRINT "(knots)     MACH      (SHP)
(SHP)       (SHP)       (SHP)"
5160 K=12:I=0:FOR L=1 TO LL:LOCATE K,8,1:INPUT O(L):LOCATE
K,18,1:INPUT TM(KK,L):LOCATE K,28,1:INPUT
PINF(KK,L):LOCATE K,40,1:INPUT POF(KK,L):LOCATE
K,52,1:INPUT PPF(KK,L)
5170 LOCATE K,64,1:INPUT PTF(KK,L):K=K+1:NEXT L:IF KK=1
THEN GOTO 5070 ELSE RETURN
```

F. CHAPTER FOUR

```
10 KEY(5) OFF
20 '*******************************************************
30 '
40 '                   TAIL ROTOR DESIGN
50 '
60 '*******************************************************
70 '
80 '             ***  CHAPTER FOUR MAIN PROGRAM  ***
90 '
100 '
110 PRINT "~C=ALL/":PRINT "~L=CH4/"
120 KEY(9) ON:ON KEY(9) GOSUB 130
130 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C4MAIN/":INPUT;"",X
140 COLOR 15,1,1:IF X=1 THEN GOSUB 430 ELSE IF X=2 THEN
GOSUB 540 ELSE IF X=3 THEN GOSUB 630 ELSE IF X=4 THEN
GOSUB 820 ELSE IF X=5 THEN GOSUB 1040 ELSE IF X=6 THEN
GOTO 430 ELSE IF X=7 THEN GOSUB 1900 ELSE
150 IF X=8 THEN GOSUB 1440 ELSE IF X=9 THEN GOSUB 1090
ELSE IF X=10 THEN GOSUB 180 ELSE IF X=11 THEN CLS:LOCATE
23,1,0:PRINT "~W=LOAD/":CHAIN "HD1",,ALL
160 '
170 '
180 '               *** STORE DATA ON FILE DISK ***
190 '
200 '
210 CLS:LOCATE 23,1,0:PRINT "~W=DISK/":GOSUB 1760:LOCATE
25,27,1:PRINT "                            ":LOCATE
23,1,0:PRINT "~W=SAVE/"
220 A(1)=SGW:A(2)=GW1:A(3)=WE:A(4)=VTIPMAX:A(5)=R:A(6)=
OMEGA:A(7)=CT:A(8)=SIGMA:A(9)=B:A(10)=C:A(11)=AR:A(12)=CL:
A(13)=CLALPHA:A(14)=CDO:A(15)=DL:A(16)=MBL:A(17)=MU:A(18)=
MAXFVEL:A(19)=TIPLOSS:A(20)=PIN:A(21)=PO:A(22)=PT:A(23)=HP
:A(24)=PERINDP:V=24
230 FOR I=1 TO 3:FOR J=1 TO 15:V=V+1:Q=J+24:A(V)=W(Q-24,I)
:NEXT J,I:FOR I=1 TO 3:A(I+69)=W2A(I):A(I+72)=W2B(I):
A(I+75)=W6A(I):A(I+78)=W6B(I):A(I+81)=W6C(I):NEXT
I:A(85)=N: A(86)=WE(N):A(87)=GW(N):A(88)=DL(N-
1):A(89)=FM(N-1):A(90)= FL:A(91)=IRLG:A(92)=NW
240 A(93)=PERDIFW:A(94)=PERDIFP:A(95)=Y:A(96)=FUEL:A(97)=
PEOPLE:A(98)=UL:A(99)=SPECIAL:A(100)=ENGINE:A(101)=ZZ:A(10
2)=AB:A(103)=GR:A(104)=RH:A(105)=H:A(106)=D:A(107)=PINI:A(
108)=PTI:A(109)=M:A(110)=EFPA:A(111)=RHO(2):A(112)=MM:A(11
3)=M(2):A(114)=CRUISEV
250 A(115)=CRU:A(116)=CRU2:A(117)=MAXF:A(118)=MAXF2:A(119)
=MAXCRU1:A(120)=ALT:A(121)=TEMP:A(122)=LL:A(123)=TR:A(124)
=TRPM:A(125)=OMEGAT:A(126)=TCDO:A(127)=BT:A(128)=TAR:A(129
)=TRC:A(130)=TTR:A(131)=CTTR:A(132)=TRB:A(133)=SIGMAT:A(13
4)=V:A(135)=SPAN
```

```
260 A(136)=S:A(137)=SWP:A(138)=SWEEP:A(139)=LAVS:A(140)=
VSAR:A(141)=BETA2:A(142)=T:A(143)=T2:A(144)=T3:A(145)=CLAT
R:A(146)=ALTR:A(147)=ALTRDEG:A(148)=TL:G=149
270 LL=LL+1:FOR I=1 TO LL:A(G)=O(I):G=G+1:NEXT I:G=G+1+LL:
G1=G+1+2*LL:G2=G1+1+2*LL:G3=G2+1+2*LL:G4=G3+1+2*LL
280 FOR I=1 TO 2:FOR J=1 TO LL:A(G)=PINF(I,J)
:A(G1)=POF(I,J) :A(G2)=PPF(I,J):A(G3)=PTF(I,J):A(G4)=TM
(I,J):G=G+1:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:NEXT J,I
290 G5=G4+2:G6=G5+2:G7=G6+2:FOR I=1 TO 2:A(G4)=PITR(I):
A(G5)=POTR(I):A(G6)=PTTR(I):A(G7)=CLTR(I):G4=G4+1:G5=G5+1:
G6=G6+1:G7=G7+1:NEXT I:G8=G7+1+2*(LL-1):G9=G8+1+2*(LL-1)
300 FOR I=1 TO 2:FOR J=2 TO LL:A(G7)=PITRF(I,J):A(G8)=
POTRF(I,J):A(G9)=PTTRF(I,J):G7=G7+1:G8=G8+1:G9=G9+1:NEXT
J,I:G10=G9+1+2*LL:G11=G10+1+2*LL:G12=G11+1+2*LL:G13=G12+1+
2*LL:G14=G13+1+2*LL
310 FOR I=1 TO 2:FOR J=1 TO LL:A(G9)=TTM(I,J):A(G10)=
TRT(I,J):A(G11)=L(I,J):A(G12)=VERSTAB(I,J):A(G13)=PTTRVSF(
I,J):A(G14)=PITRFI(I,J):G9=G9+1:G10=G10+1:G11=G11+1:G12=G1
2+1:G13=G13+1:G14=G14+1:NEXT J,I
320 LL(2)=162+(32*LL):LL=LL-1
330 Z=4:OPEN "B:DATA1" FOR OUTPUT AS #1:PRINT #1, Z
340 FOR I=1 TO 10:PRINT #1, LL(I):NEXT I:CLOSE #1
350 OPEN "B:DATA4" FOR OUTPUT AS #1:FOR I=1 TO LL(2):PRINT
#1, A(I):NEXT I:CLOSE #1:RETURN 120
360 '
370 '
380 '
390 '
400 '                        *** SECTION 4.1 ***
410 '
420 '
430 CLS:LOCATE 5,30,1:PRINT "*** SECTION 4.1 ***":LOCATE
7,22,1:PRINT "-PRELIMINARY SIZING OF TAIL ROTOR-"
440 TR = 1.3*SQR(SGW/1000):TRPM = 135*OMEGA/PI:OMEGAT
=4.5*OMEGA:TCDO=CDO
450 LOCATE 10,25,1:PRINT "TAIL ROTOR RADIUS=";TR:LOCATE
12,25,1:PRINT "TAIL ROTOR RPM=";TRPM:LOCATE 14,25,1:PRINT
"TAIL ROTOR CDO=";TCDO:LOCATE 16,25,1:INPUT "ENTER
ESTIMATE OF TAIL ROTOR ASPECT RATIO";TAR:TRC = TR/TAR
460 LOCATE 23,35,1:INPUT "ANY CHANGES(Y/N)";A$:IF A$="Y"
THEN GOTO 450 ELSE IF A$="y" GOTO 450 ELSE IF A$="N" GOTO
480 ELSE IF A$="n" GOTO 480 ELSE
470 LOCATE 25,27,1:PRINT "you must enter (y/n) try
again":GOTO 460
480 IF X=6 THEN GOTO 500 ELSE RETURN 120
490 '
500 '
```

```
510 '                       *** SECTION 4.2 ***
520 '
530 '
540 CLS:LOCATE 5,30,1:PRINT "*** SECTION 4.2 ***":LOCATE
7,21,1:PRINT "-TAIL ROTOR POWER REQUIRED AT HOVER-"
550 LOCATE 10,8,1:PRINT "USING HD-7 MAKE AN ESTIMATE OF
THE DISTANCE FROM THE CENTER OF TAIL":LOCATE 11,8,1:INPUT
"ROTOR THRUST TO THE CENTER OF GRAVITY (ie. tail
length)";TL:LOCATE 13,20,1:INPUT "ENTER NUMBER OF TAIL
ROTOR BLADES";BT
560 FOR I=1 TO 2:RHO(1)=RHO:TRA=PI*TR^2:TRVT=OMEGAT*TR
570 TTR=(PT*550)/(OMEGA*TL):CTTR(I)=TTR/(PI*(TR^4)*RHO(I)*
(OMEGAT^2)):TRB=1-((SQR(2*CTTR(I)))/BT):PITR(I)=
(((TTR^1.5)/SQR(2*PI*(TR^2)*RHO(I)))/TRB)/550:SIGMAT=(BT*T
RC)/(PI*TR):POTR(I)=(SIGMAT*TCDO*RHO(I)*TRA*TRVT^3)/4400:P
TTR(I)=PITR(I)+POTR(I)
590 NEXT I:IF TT=1 THEN GOTO 670 ELSE
600 LOCATE 15,20,1:PRINT "TAIL ROTOR POWER IN HOVER
=";PTTR(1):LOCATE 17,20,1:PRINT "TAIL ROTOR INDUCED POWER
=";PITR(1):LOCATE 19,20,1:PRINT "TAIL ROTOR PROFILE POWER
=";POTR(1):GOSUB 1760:IF X=6 THEN GOTO 610 ELSE RETURN 120
610 '
620 '
630 '                          *** SECTION 4.3 ***
640 '
650 '
660 CLS:LOCATE 2,30,1:PRINT "*** SECTION 4.3 ***":LOCATE
3,16,1:PRINT "-TAIL ROTOR POWER REQUIRED FOR FORWARD
FLIGHT-":LOCATE 15,35,0:PRINT "~W=COMP/":VTTR=OMEGAT*TR
670 TRA=PI*(TR^2):RHO(1)=RHO:LL=LL+1:FOR I=1 TO 2:FOR J=1
TO LL:CTTR(I)=PTF(I,J)*550/(OMEGA*TL*RHO(I)*TRA*(VTTR)^2)
:TIP=1-(SQR(2*CTTR(I))/BT):VF=1.687778*O(J):VITR=SQR((-
(VF^2)/2)+ SQR((((VF^2)/2)^2)+((PTF(I,J)*550)^2)/((2*TRA*
RHO(I)* TL*OMEGA)^2)))
680 MU2=VF/(OMEGAT*TR):PITRF(I,J)=(((PTF(I,J)*550)/(TL*
OMEGA))*VITR)/(550*TIP):POTRF(I,J)=SIGMAT*CDO*RHO(I)*TRA*(
(OMEGAT*TR)^3)*(1+(4.3*(MU2^2)))/4400
690 PTTRF(I,J)=PITRF(I,J)+POTRF(I,J):NEXT J,I:LL=LL-1:FOR
I=1 TO 2:PTTRF(I,1)=PTTR(I):PITRF(I,1)=PITR(I):POTRF(I,1)
=POTR(I):NEXT I
700 FOR KK=1 TO 2:GOSUB 710:NEXT KK:IF X=8 THEN RETURN
1470 ELSE IF AP=1 THEN LPRINT CHR$ (12):RETURN 1090 ELSE
IF AQ=1 THEN AQ=0:GOTO 120 ELSE IF X=6 GOTO 800 ELSE GOTO
120
710 CLS:LOCATE 2,33,1:PRINT "TAIL ROTOR POWER"
720 IF KK=1 THEN LOCATE 4,32,1:PRINT "STANDARD SEA
LEVEL":LOCATE 5,20,1:PRINT "ALTITUDE = 0 FT
TEMPERATURE = 59 DEG. F" ELSE
730 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
```

```
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F"
740 LOCATE 7,39,1:PRINT "----------- POWER ----------
":LOCATE 9,17,1:PRINT "AIRSPEED     TIP      INDUCED
PROFILE     TOTAL"
750 LOCATE 10,18,1:PRINT "(knots)     MACH      (SHP)
(SHP)      (SHP)"
760 A$="###.#":B$="#.###":C$="####.##":K=12:LOCATE
12,18,1:PRINT USING A$;O(1):LOCATE 12,29,1:PRINT USING
B$;TTM(KK,1):LOCATE 12,38,1:PRINT USING C$;PITR(KK):LOCATE
12,49,1:PRINT USING C$;POTR(KK):LOCATE 12,60,1:PRINT USING
C$;PTTR(KK):K=13:FOR L=2 TO LL
770 LOCATE K,18,1:PRINT USING A$;O(L):LOCATE K,29,1:PRINT
USING B$;TTM(KK,L):LOCATE K,38,1:PRINT USING
C$;PITRF(KK,L):LOCATE K,49,1:PRINT USING
C$;POTRF(KK,L):LOCATE K,60,1:PRINT USING C$;PTTRF(KK,L)
780 K=K+1:NEXT L
790 IF AP=1 THEN LCOPY:RETURN ELSE GOSUB 1760:RETURN
800 '
810 '
820 '                    *** SECTION 4.4 ***
830 '
840 '
850 CLS:LOCATE 2,30,1:PRINT "*** SECTION 4.4 ***":LOCATE
3,29,1:PRINT "-VERTICAL STABILIZER-":LOCATE 5,5,1:PRINT
"ENTER THE AIRSPEED FOR VERTICAL STABILIZER TO UNLOAD THE
TAIL ROTOR"
860 LOCATE 6,18,1:INPUT "(airspeed must be of a 20 knot
increment)";V:LOCATE 8,15,1:PRINT "TAIL ROTOR SOLIDITY
=";SIGMAT
870 LOCATE 9,15,1:INPUT "FROM FIGURE 4.1 SELECT AND ENTER
THE PLANFORM AREA";S:LOCATE 11,15,1:INPUT "ENTER SPAN OF
VERTICAL STABILIZER";SPAN:LOCATE 13,15,1:INPUT "ENTER
SWEEP OF VERTICAL STABILIZER AT MID-
CHORD";SWP:SWEEP=SWP*PI/180
880 LOCATE 15,15,1:INPUT "ENTER LEVER ARM FOR VERTICAL
STABILIZER";LAVS
890 FOR I=1 TO LL:IF V=O(I) THEN VI=I:GOTO 900 ELSE NEXT I
900 VF1=(O(VI))*1.687778:FOR I=1 TO
2:L1(I)=(((PTF(I,VI)*550)/OMEGA)/LAVS):CLTR(I)=(2*L1(I))/(
(VF1^2)*S*RHO(I)):NEXT I:VSAR=((SPAN)^2)/S
910 BETA2=1-((VF1/A)^2):T=(VSAR*2*PI):T1=(1+((TAN(SWEEP))
^2) /BETA2):T2=((VSAR^2)*BETA2):T3=2+SQR(T1*T2+4):CLATR=
T/T3:TA=(TAN(SWEEP))^2:TEFPA=(8.999999E-03+CLTR(1)^2/
(PI*VSAR)) *S:TPP=RHO(1)*(V*1.687778)^3*TEFPA/1100
920 ALTR=(CLTR(1)-.4)/CLATR:ALTRDEG=ALTR*(180/PI):LOCATE
17,15,1:PRINT "ANGLE OF ATTACK FOR VERTICAL STABILIZER
(deg) =";USING "##.##";ALTRDEG:LOCATE 19,15,0:PRINT
"EQUIVALENT FLAT PLATE AREA OF VERTICAL STABILIZER
=";TEFPA
```

```
930 LOCATE 21,15,0:PRINT "ADDITIONAL PARASITE POWER AT
THIS AIRSPEED =";TPP
940 LOCATE 23,30,1:INPUT "ANY CHANGES(Y/N)";E$:IF E$="Y"
THEN GOTO 850 ELSE IF E$="y" GOTO 850 ELSE IF E$="N" THEN
GOTO 960 ELSE IF E$="n" THEN GOTO 960 ELSE
950 LOCATE 25,25,1:PRINT "you must enter (y/n) try
again":LOCATE 22,47,1:PRINT "           ":GOTO 940
960 LOCATE 25,25,1:PRINT "
":LOCATE 15,35,0:PRINT "~W=COMP/":FOR I=1 TO 2:FOR J=1 TO
LL:VF=O(J)*1.687778:L(I,J)=(.5)*RHO(I)*S*(VF^2)*CLTR(I):VE
RSTAB(I,J)=(L(I,J)*OMEGA*LAVS)/550:NEXT J,I
970 FOR I=1 TO 2:FOR J=1 TO LL:PTF5(I,J)=ABS(PTF(I,J)-
VERSTAB(I,J)):NEXT J,I
980 TRA=PI*(TR^2):RHO(1)=RHO:FOR I=1 TO 2:FOR J=1 TO LL:VF
=1.687778*O(J):VITR1=SQR((-(VF^2)/2)+SQR((((VF^2)/2)^2)+
((PTF5(I,J)*550)^2)/((2*TRA*RHO(I)*TL*OMEGA)^2))):MU2=VF/(
OMEGA*R):PITRFI(I,J)=(((PTF5(I,J)*550)/(TL*OMEGA))*VITR1)/
550
990 TRT(I,J)=(PTF(I,J)*550)/(TL*OMEGA)
1000 PTTRVSF(I,J)=PITRFI(I,J)+POTRF(I,J):NEXT J,I:GOSUB
1790
1010 IF X=6 GOTO 1020 ELSE GOTO 120
1020 '
1030 '
1040 '                    *** SECTION 4.5 ***
1050 '
1060 '
1070 CLS:LOCATE 5,30,1:PRINT "*** SECTION 4.5 ***":LOCATE
6,25,1:PRINT "-TAIL ROTOR TIP MACH NUMBER-":LOCATE
23,1,0:PRINT "~W=COMP/"
1080 M(1)=A:FOR I=1 TO 2:FOR J=1 TO LL:VF=O(J)*1.687778:
TTM(I,J)=((OMEGAT*TR)+VF)/M(I):NEXT J,I:AQ=1:GOSUB 700
1090 '                       *** PRINT OUT DATA ***
1100 '
1110 '
1120 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C4PRINT/":INPUT;"",PR:COLOR 15,1,1
1130 AP=0:IF PR=1 THEN GOTO 1140 ELSE IF PR=2 THEN
AP=1:GOSUB 1790 ELSE IF PR=3 THEN AP=1:GOSUB 700 ELSE IF
PR=4 THEN AP=0:RETURN 120
1140 CLS:LOCATE 23,1,0:PRINT "~W=PRINTER/":GOSUB
1760:LOCATE 25,27,0:PRINT "
"
1150 LPRINT TAB(25) "TABLE OF CHAPTER FOUR RESULTS"
1160 LPRINT
1170 LPRINT
1180 LPRINT
1190 LPRINT TAB(12) "TAIL ROTOR RADIUS";TAB(57) TR
1200 LPRINT TAB(12) "TAIL ROTOR ROTATIONAL
VELOCITY";TAB(57) OMEGAT
1210 LPRINT TAB(12) "TAIL ROTOR RPM";TAB(57) TRPM
```

```
1220 LPRINT TAB(12) "TAIL ROTOR THRUST
COEFFICIENT";TAB(57) CT
1230 LPRINT TAB(12) "TAIL ROTOR BLADE SOLIDITY";TAB(57)
SIGMAT
1240 LPRINT TAB(12) "NUMBER OF TAIL ROTOR BLADES";TAB(57)
BT
1250 LPRINT TAB(12) "TAIL ROTOR BLADE CHORD";TAB(57) TRC
1260 LPRINT TAB(12) "TAIL ROTOR BLADE ASPECT
RATIO";TAB(57) TAR
1270 LPRINT TAB(12) "TAIL ROTOR BLADE DRAG
COEFFICIENT";TAB(57) TCDO
1280 LPRINT TAB(12) "TAIL ROTOR TIPLOSS";TAB(57) TRB
1290 LPRINT TAB(12) "TAIL ROTOR INDUCED POWER IN HOVER
OGE";TAB(57) PITR(1)
1300 LPRINT TAB(12) "TAIL ROTOR PROFILE POWER IN HOVER
OGE";TAB(57) POTR(1)
1310 LPRINT TAB(12) "TAIL ROTOR TOTAL POWER IN HOVER
OGE";TAB(57) PTTR(1)
1320 LPRINT TAB(12) "TAIL ROTOR INDUCED POWER IN HOVER
IGE";TAB(57) PITR(2)
1330 LPRINT TAB(12) "TAIL ROTOR TOTAL POWER IN HOVER
IGE";TAB(57) PTTR(2)
1340 LPRINT TAB(12) "TAIL LENGTH";TAB(57) TL
1350 LPRINT TAB(12) "VERTICAL STABILIZER PLANFORM
AREA";TAB(57) S
1360 LPRINT TAB(12) "VERTICAL STABILIZER SPAN";TAB(57)
SPAN
1370 LPRINT TAB(12) "VERTICAL STABILIZER SWEEP AT MID-
CHORD";TAB(57) SWP
1380 LPRINT TAB(12) "VERTICAL STABILIZER ASPECT
RATIO";TAB(57) VSAR
1390 LPRINT TAB(12) "VERTICAL STABILIZER ANGLE OF
ATTACK";TAB(57) ALTRDEG
1400 LPRINT TAB(12) "VERTICAL STABILIZER COEFFICIENT OF
LIFT";TAB(57) CLTR(1)
1410 LPRINT TAB(12) "VERTICAL STABILIZER LIFT CURVE
SLOPE";TAB(57) CLATR
1420 LPRINT TAB(12) "LEVER ARM OF VERTICAL
STABILIZER";TAB(57) LAVS
1430 LPRINT CHR$ (12):GOTO 1120
1440 '                          *** PRINT OUT DATA ***
1450 '
1460 '
1470 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C4RESULT/":INPUT;"",PR:COLOR 15,1,1
1480 AP=0:IF PR=1 THEN GOTO 1490 ELSE IF PR=2 THEN GOSUB
1790 ELSE IF PR=3 THEN GOSUB 700 ELSE IF PR=4 THEN RETURN
120
1490 CLS:LOCATE 2,25,1:PRINT "TABLE OF CHAPTER FOUR
RESULTS"
1500 LOCATE 5,12,1:PRINT "TAIL ROTOR RADIUS";TAB(57) TR
```

```
1510 PRINT TAB(12) "TAIL ROTOR ROTATIONAL
VELOCITY";TAB(57) OMEGAT
1520 PRINT TAB(12) "TAIL ROTOR RPM";TAB(57) TRPM
1530 PRINT TAB(12) "TAIL ROTOR THRUST COEFFICIENT";TAB(57)
CTTR(1)
1540 PRINT TAB(12) "TAIL ROTOR BLADE SOLIDITY";TAB(57)
SIGMAT
1550 PRINT TAB(12) "NUMBER OF TAIL ROTOR BLADES";TAB(57)
BT
1560 PRINT TAB(12) "TAIL ROTOR BLADE CHORD";TAB(57) TRC
1570 PRINT TAB(12) "TAIL ROTOR BLADE ASPECT RATIO";TAB(57)
TAR
1580 PRINT TAB(12) "TAIL ROTOR BLADE DRAG
COEFFICIENT";TAB(57) TCDO
1590 PRINT TAB(12) "TAIL ROTOR TIPLOSS";TAB(57) TRB
1600 PRINT TAB(12) "TAIL ROTOR INDUCED POWER IN HOVER
OGE";TAB(57) PITR(1)
1610 PRINT TAB(12) "TAIL ROTOR PROFILE POWER IN HOVER
OGE";TAB(57) POTR(1)
1620 PRINT TAB(12) "TAIL ROTOR TOTAL POWER IN HOVER
OGE";TAB(57) PTTR(1)
1630 PRINT TAB(12) "TAIL ROTOR INDUCED POWER IN HOVER
IGE";TAB(57) PITR(2)
1640 PRINT TAB(12) "TAIL ROTOR TOTAL POWER IN HOVER
IGE";TAB(57) PTTR(2)
1650 PRINT TAB(12) "TAIL LENGTH";TAB(57) TL
1660 GOSUB 1760
1670 CLS:LOCATE 5,12,1:PRINT TAB(12) "VERTICAL STABILIZER
PLANFORM AREA";TAB(57) S
1680 PRINT TAB(12) "VERTICAL STABILIZER SPAN";TAB(57) SPAN
1690 PRINT TAB(12) "VERTICAL STABILIZER SWEEP AT MID-
CHORD";TAB(57) SWP
1700 PRINT TAB(12) "VERTICAL STABILIZER ASPECT
RATIO";TAB(57) VSAR
1710 PRINT TAB(12) "VERTICAL STABILIZER ANGLE OF
ATTACK";TAB(57) ALTRDEG
1720 PRINT TAB(12) "VERTICAL STABILIZER COEFFICIENT OF
LIFT";TAB(57) CLTR(1)
1730 PRINT TAB(12) "VERTICAL STABILIZER LIFT CURVE
SLOPE";TAB(57) CLATR
1740 PRINT TAB(12) "LEVER ARM OF VERTICAL
STABILIZER";TAB(57) LAVS
1750 GOSUB 1760:GOTO 1470
1760 IF AP=1 THEN LOCATE 25,79,0 ELSE LOCATE 25,27,0:PRINT
"press any key to continue"
1770 A$=INKEY$:IF A$="" THEN 1770
1780 RETURN
1790 FOR KK=1 TO 2:GOSUB 1800:NEXT KK:IF AP=1 THEN LPRINT
CHR$ (12):RETURN 1110 ELSE IF X=8 THEN RETURN 1470 ELSE
RETURN
```

```
1800 CLS:LOCATE 2,20,1:PRINT "TAIL ROTOR POWER WITH
VERTICAL STABILIZER"
1810 IF KK=1 THEN LOCATE 4,32,1:PRINT "STANDARD SEA
LEVEL":LOCATE 5,20,1:PRINT "ALTITUDE = 0 FT
TEMPERATURE = 59 DEG. F" ELSE
1820 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F"
1830 LOCATE 7,13,1:PRINT "----THRUST----     -------------
--------- POWER -------------------":LOCATE 9,13,1:PRINT
"TAIL     VERT/     MAIN     VERT/":LOCATE 10,3,1:PRINT
"AIRSPEED  ROTOR    STAB      ROTOR    STAB   INDUCED
PROFILE  TOTAL with v/s"
1840 LOCATE 11,4,1:PRINT "(knots)  (lbf)    (lbf)
(SHP)   (*SHP*)  (SHP)    (SHP)       (SHP)"
1850
A$="###.#":B$="####.#":C$="####.#":D$="#####.#":LOCATE
13,4,1:PRINT USING A$;O(1):LOCATE 13,12,1:PRINT USING
B$;TRT(KK,1):LOCATE 13,21,1:PRINT USING B$;L(KK,1):LOCATE
13,31,1:PRINT USING C$;PTF(KK,1):LOCATE 13,39,1:PRINT
USING D$;VERSTAB(KK,1)
1860 LOCATE 13,48,1:PRINT USING C$;PITR(KK):LOCATE
13,57,1:PRINT USING C$;POTR(KK):LOCATE 13,69,1:PRINT USING
C$;PTTR(KK)
1870 K=14:FOR L=2 TO LL:LOCATE K,4,1:PRINT USING
A$;O(L):LOCATE K,12,1:PRINT USING B$;TRT(KK,L):LOCATE
K,21,1:PRINT USING B$;L(KK,L):LOCATE K,31,1:PRINT USING
C$;PTF(KK,L):LOCATE K,39,1:PRINT USING D$;VERSTAB(KK,L)
1880 LOCATE K,48,1:PRINT USING C$;PITRFI(KK,L):LOCATE
K,57,1:PRINT USING C$;POTRF(KK,L):LOCATE K,69,1:PRINT
USING C$;PTTRVSF(KK,L):K=K+1:NEXT L
1890 IF AP=1 THEN LCOPY:RETURN ELSE GOSUB 1760:RETURN
1900 '                      *** DATA INPUT ***
1910 '
1920 '
1930 '
1940 COLOR 1,1,1:CLS:PRINT "~W=INPUT/":INPUT;"",WW:COLOR
15,1,1
1950 IF WW=1 THEN GOTO 1970 ELSE IF WW=2 GOTO 2570 ELSE IF
WW=3 GOTO 2710 ELSE IF WW=4 THEN RETURN 120 ELSE
1960 '
1970 CLS:LOCATE 2,25,1:PRINT "CHAPTER FOUR DATA INPUT"
1980 LOCATE 5,12,1:PRINT "1.  TAIL ROTOR RADIUS"
1990 PRINT TAB(12) "2.  TAIL ROTOR ROTATIONAL VELOCITY"
2000 PRINT TAB(12) "3.  TAIL ROTOR RPM"
2010 PRINT TAB(12) "4.  TAIL ROTOR THRUST COEFFICIENT"
2020 PRINT TAB(12) "5.  TAIL ROTOR BLADE SOLIDITY"
2030 PRINT TAB(12) "6.  NUMBER OF TAIL ROTOR BLADES"
2040 PRINT TAB(12) "7.  TAIL ROTOR BLADE CHORD"
2050 PRINT TAB(12) "8.  TAIL ROTOR BLADE ASPECT RATIO"
```

```
2060 PRINT TAB(12) "9.  TAIL ROTOR BLADE DRAG COEFFICIENT"
2070 PRINT TAB(12) "10. TAIL ROTOR TIPLOSS"
2080 PRINT TAB(12) "11. TAIL ROTOR INDUCED POWER IN HOVER
OGE"
2090 PRINT TAB(12) "12. TAIL ROTOR PROFILE POWER IN HOVER
OGE"
2100 PRINT TAB(12) "13. TAIL ROTOR TOTAL POWER IN HOVER
OGE"
2110 PRINT TAB(12) "14. TAIL ROTOR INDUCED POWER IN HOVER
IGE"
2120 PRINT TAB(12) "15. TAIL ROTOR TOTAL POWER IN HOVER
IGE"
2130 PRINT TAB(12) "16. TAIL LENGTH"
2140 PRINT TAB(12) "17. CONTINUE"
2150 LOCATE 23,26,1:INPUT "WHICH DO YOU WANT TO ENTER";X
2160 IF X<1 OR X>17 THEN LOCATE 23,53,1:PRINT "
":GOTO 2150 ELSE ON X GOTO
2180,2190,2200,2210,2220,2230,2240,2250,2260,2270,2280,229
0,2300,2310,2320,2330,2340
2170 LOCATE 23,53,1:PRINT "                    ":GOTO 2150
2180 LOCATE 5,57,1:INPUT TR:GOTO 2170
2190 LOCATE 6,57,1:INPUT OMEGAT:GOTO 2170
2200 LOCATE 7,57,1:INPUT TRPM:GOTO 2170
2210 LOCATE 8,57,1:INPUT CT:GOTO 2170
2220 LOCATE 9,57,1:INPUT SIGMAT:GOTO 2170
2230 LOCATE 10,57,1:INPUT BT:GOTO 2170
2240 LOCATE 11,57,1:INPUT TRC:GOTO 2170
2250 LOCATE 12,57,1:INPUT TAR:GOTO 2170
2260 LOCATE 13,57,1:INPUT TCDO:GOTO 2170
2270 LOCATE 14,57,1:INPUT TRB:GOTO 2170
2280 LOCATE 15,57,1:INPUT PITR(1):GOTO 2170
2290 LOCATE 16,57,1:INPUT POTR(1):GOTO 2170
2300 LOCATE 17,57,1:INPUT PTTR(1):GOTO 2170
2310 LOCATE 18,57,1:INPUT PITR(2):GOTO 2170
2320 LOCATE 19,57,1:INPUT PTTR(2):GOTO 2170
2330 LOCATE 20,57,1:INPUT TL:GOTO 2170
2340 GOTO 2350
2350 CLS:LOCATE 5,12,1:PRINT TAB(12) "18. VERTICAL
STABILIZER PLANFORM AREA"
2360 PRINT TAB(12) "19. VERTICAL STABILIZER SPAN"
2370 PRINT TAB(12) "20. VERTICAL STABILIZER SWEEP AT MID-
CHORD"
2380 PRINT TAB(12) "21. VERTICAL STABILIZER ASPECT RATIO"
2390 PRINT TAB(12) "22. VERTICAL STABILIZER ANGLE OF
ATTACK"
2400 PRINT TAB(12) "23. VERTICAL STABILIZER COEFFICIENT OF
LIFT"
2410 PRINT TAB(12) "24. VERTICAL STABILIZER LIFT CURVE
SLOPE"
2420 PRINT TAB(12) "25. LEVER ARM OF VERTICAL STABILIZER"
2430 PRINT TAB(12) "26. RETURN TO DATA INPUT MENU"
```

```
2440 LOCATE 23,26,1:INPUT "WHICH DO YOU WANT TO
ENTER";X:XX=X-17
2450 IF X<18 OR X>26 THEN LOCATE 23,53,1:PRINT "
":GOTO 2440
2460 ON XX GOTO
2480,2490,2500,2510,2520,2530,2540,2550,2560
2470 LOCATE 23,53,1:PRINT "                    ":GOTO 2440
2480 LOCATE 5,57,1:INPUT S:GOTO 2470
2490 LOCATE 6,57,1:INPUT SPAN:GOTO 2470
2500 LOCATE 7,57,1:INPUT SWP:GOTO 2470
2510 LOCATE 8,57,1:INPUT VSAR:GOTO 2470
2520 LOCATE 9,57,1:INPUT ALTRDEG:GOTO 2470
2530 LOCATE 10,57,1:INPUT CLTR(1):GOTO 2470
2540 LOCATE 11,57,1:INPUT CLATR:GOTO 2470
2550 LOCATE 12,57,1:INPUT LAVS:GOTO 2470
2560 GOTO 1900
2570 CLS:LOCATE 10,10,1:INPUT "DO YOU HAVE ENTRIES FOR SEA
LEVEL (Y/N)";A$:IF A$="Y" THEN KK=1:GOTO 2590 ELSE IF
A$="y" THEN KK=1:GOTO 2590 ELSE IF A$="N" GOTO 2630 ELSE
IF A$="n" GOTO 2630 ELSE
2580 LOCATE 23,27,1:PRINT "you must enter (y/n) try
again":GOSUB 1760:GOTO 2570
2590 LOCATE 12,10,1:INPUT "ENTER THE NUMBER OF AIRSPEEDS
YOU HAVE CALCULATIONS FOR";LL:LOCATE 14,10,1:PRINT "IF YOU
DO NOT HAVE AN ENTRY FOR A TABLE ITEM JUST HIT THE ENTER
KEY":LOCATE 15,10,1:PRINT "AND THE CURSOR WILL MOVE TO THE
NEXT ENTRY POINT"
2600 GOSUB 1760:GOTO 2640
2610 CLS:LOCATE 10,10,1:INPUT "DO YOU HAVE ANY ENTRIES FOR
SPECIFICATION ALTITUDE (Y/N)";B$:IF B$="Y" THEN GOTO 2630
ELSE IF B$="y" GOTO 2630 ELSE IF B$="N" GOTO 1900 ELSE IF
B$="n" GOTO 1900 ELSE
2620 LOCATE 23,27,1:PRINT "you must enter (y/n) try
again":GOSUB 1760:GOTO 2610
2630 LOCATE 12,10,1:INPUT "ENTER SPECIFICATION
ALTITUDE";ALT:LOCATE 14,10,1:INPUT "ENTER SPECIFICATION
TEMPERATURE";TEMP:LOCATE 16,10,1:INPUT "ENTER NUMBER OF
AIRSPEEDS YOU HAVE CALCULATIONS FOR";LL:KK=2
2640 CLS:LOCATE 2,33,1:PRINT "TAIL ROTOR POWER"
2650 IF KK=1 THEN LOCATE 4,32,1:PRINT "STANDARD SEA
LEVEL":LOCATE 5,20,1:PRINT "ALTITUDE = 0 FT
TEMPERATURE = 59 DEG. F" ELSE
2660 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F"
2670 LOCATE 7,39,1:PRINT "----------- POWER ----------
":LOCATE 9,17,1:PRINT "AIRSPEED     TIP      INDUCED
PROFILE     TOTAL"
2680 LOCATE 10,18,1:PRINT "(knots)     MACH      (SHP)
(SHP)      (SHP)"
```

```
2690 K=12:FOR L=1 TO LL:LOCATE K,18,1:INPUT O(L):LOCATE
K,29,1:INPUT TTM(KK,L):LOCATE K,38,1:INPUT
PITRF(KK,L):LOCATE K,49,1:INPUT POTRF(KK,L):LOCATE
K,60,1:INPUT PTTRF(KK,L):K=K+1:NEXT L
2700 IF KK=1 THEN GOTO 2610 ELSE GOTO 1900
2710 CLS:LOCATE 10,10,1:INPUT "DO YOU HAVE ENTRIES FOR SEA
LEVEL (Y/N)";A$:IF A$="Y" THEN KK=1:GOTO 2730 ELSE IF
A$="y" THEN KK=1:GOTO 2730 ELSE IF A$="N" GOTO 2770 ELSE
IF A$="n" GOTO 2770 ELSE
2720 LOCATE 23,27,1:PRINT "you must enter (y/n) try
again":GOSUB 1760:GOTO 2710
2730 LOCATE 12,10,1:INPUT "ENTER THE NUMBER OF AIRSPEEDS
YOU HAVE CALCULATIONS FOR";LL:LOCATE 14,10,1:PRINT "IF YOU
DO NOT HAVE AN ENTRY FOR A TABLE ITEM JUST HIT THE ENTER
KEY":LOCATE 15,10,1:PRINT "AND THE CURSOR WILL MOVE TO THE
NEXT ENTRY POINT"
2740 GOSUB 1760:GOTO 2780
2750 CLS:LOCATE 10,10,1:INPUT "DO YOU HAVE ANY ENTRIES FOR
SPECIFICATION ALTITUDE (Y/N)";B$:IF B$="Y" THEN GOTO 2770
ELSE IF B$="y" GOTO 2770 ELSE IF B$="N" GOTO 1900 ELSE IF
B$="n" GOTO 1900 ELSE
2760 LOCATE 23,27,1:PRINT "you must enter (y/n) try
again":GOSUB 1760:GOTO 2750
2770 LOCATE 12,10,1:INPUT "ENTER SPECIFICATION
ALTITUDE";ALT:LOCATE 14,10,1:INPUT "ENTER SPECIFICATION
TEMPERATURE";TEMP:LOCATE 16,10,1:INPUT "ENTER NUMBER OF
AIRSPEEDS YOU HAVE CALCULATIONS FOR";LL:KK=2
2780 CLS:LOCATE 2,20,1:PRINT "TAIL ROTOR POWER WITH
VERTICAL STABILIZER"
2790 IF KK=1 THEN LOCATE 4,32,1:PRINT "STANDARD SEA
LEVEL":LOCATE 5,20,1:PRINT "ALTITUDE = 0 FT
TEMPERATURE = 59 DEG. F" ELSE
2800 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F"
2810 LOCATE 7,13,1:PRINT "----THRUST----     -------------
--------- POWER --------------------":LOCATE 9,13,1:PRINT
"TAIL     VERT/     MAIN     VERT/":LOCATE 10,3,1:PRINT
"AIRSPEED  ROTOR    STAB      ROTOR    STAB   INDUCED
PROFILE  TOTAL with v/s"
2820 LOCATE 11,4,1:PRINT "(knots)  (lbf)    (lbf)
(SHP)    (SHP)   (SHP)    (SHP)       (SHP)"
2830 K=14:FOR L=1 TO LL:LOCATE K,4,1:INPUT O(L):LOCATE
K,12,1:INPUT TRT(KK,L):LOCATE K,21,1:INPUT L(KK,L):LOCATE
K,31,1:INPUT PTF(KK,L):LOCATE K,40,1:INPUT VERSTAB(KK,L)
2840 LOCATE K,48,1:INPUT PITRF1(KK,L):LOCATE K,57,1:INPUT
POTRF(KK,L):LOCATE K,69,1:INPUT PTTRVSF(KK,L):K=K+1:NEXT
L:IF KK=1 THEN GOTO 2750 ELSE GOTO 1900
```

G. CHAPTER FIVE

```
10 KEY(5) OFF
20 '******************* CHAPTER FIVE *********************
30 '
40 '                  POWER REFINEMENTS
50 '
60 '******************************************************
70 '
80 '           ***  CHAPTER FIVE MAIN PROGRAM  ***
90 '
100 '
110 PRINT "~C=ALL/":PRINT "~L=CH5/"
120 KEY(9) ON:ON KEY(9) GOSUB 130
130 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C5MAIN/":INPUT;"",X
140 COLOR 15,1,1:IF X=1 THEN CHAIN "BLDOP",,ALL ELSE IF
X=3 THEN GOSUB 440 ELSE IF X=4 THEN GOSUB 540 ELSE IF X=5
THEN GOSUB 810 ELSE IF X=6 THEN GOTO 970 ELSE IF X=7 THEN
GOSUB 1090 ELSE
150 IF X=8 THEN GOSUB 1150 ELSE IF X=9 THEN GOSUB 1220
ELSE IF X=10 THEN GOSUB 1330 ELSE IF X=12 THEN GOSUB 1450
ELSE IF X=13 THEN GOSUB 1570 ELSE IF X=14 THEN GOSUB 1720
ELSE IF X=15 THEN GOSUB 1870 ELSE
160 IF X=16 THEN GOSUB 440 ELSE IF X=17 THEN GOSUB 2100
ELSE IF X=18 THEN GOSUB 1990 ELSE IF X=19 THEN GOSUB 220
ELSE IF X=20 THEN CLS:LOCATE 23,1,0:PRINT "~W=LOAD/":CHAIN
"HD1",,ALL
170 LOCATE 25,54,1:PRINT "                    ":GOTO 140
180 '
190 '
200 '                  *** STORE DATA ON FILE DISK ***
210 '
220 CLS:LOCATE 23,1,0:PRINT "~W=DISK/":GOSUB 2410:LOCATE
25,27,1:PRINT "                            ":LOCATE
23,1,0:PRINT "~W=SAVE/"
230 A(1)=SGW:A(2)=GW1:A(3)=WE:A(4)=VTIPMAX:A(5)=R:A(6)=
OMEGA:A(7)=CT:A(8)=SIGMA:A(9)=B:A(10)=C:A(11)=AR:A(12)=CL:
A(13)=CLALPHA:A(14)=CDO:A(15)=DL:A(16)=MBL:A(17)=MU:A(18)=
MAXFVEL:A(19)=TIPLOSS:A(20)=PIN:A(21)=PO:A(22)=PT:A(23)=HP
:A(24)=PERINDP
240 V=24:FOR I=1 TO 3:FOR J=1 TO 15:V=V+1:Q=J+24:A(V)=W(Q-
24,I):NEXT J,I:FOR I=1 TO 3:A(I+69)=W2A(I):A(I+72)=
W2B(I):A(I+75)=W6A(I):A(I+78)=W6B(I):A(I+81)=W6C(I):NEXT
I:A(85)=N:A(86)=WE(N):A(87)=GW(N):A(88)=DL(N-
1):A(89)=FM(N-1):A(90)=FL:A(91)=IRLG
250 A(92)=NW
260 A(93)=PERDIFW:A(94)=PERDIFP:A(95)=Y:A(96)=FUEL:A(97)=
PEOPLE:A(98)=UL:A(99)=SPECIAL:A(100)=ENGINE:A(101)=ZZ:A(10
2)=AB:A(103)=GR:A(104)=RH:A(105)=H:A(106)=D:A(107)=PINI:A(
108)=PTI:A(109)=M:A(110)=EFPA:A(111)=RHO(2):A(112)=MM:A(11
3)=M(2):A(114)=CRUISEV
270 A(115)=CRU:A(116)=CRU2:A(117)=MAXF:A(118)=MAXF2:A
(119)=MAXCRU1:A(120)=ALT:A(121)=TEMP:A(122)=LL:A(123)=TR:A
(124)=TRPM:A(125)=OMEGAT:A(126)=TCDO:A(127)=BT:A(128)=TAR:
A(129)=TRC:A(130)=TTR:A(131)=CTTR:A(132)=TRB:A(133)=SIGMAT
:A(134)=V:A(135)=SPAN
280 A(136)=S:A(137)=SWP:A(138)=SWEEP:A(139)=LAVS:A(140)=
VSAR:A(141)=BETA2:A(142)=T:A(143)=T2:A(144)=T3:A(145)=CLAT
R:A(146)=ALTR:A(147)=ALTRDEG:A(148)=TL:A(149)=BLTW:A(150)=
CM:A(151)=THT:A(152)=AM:A(153)=AMAX:A(154)=PINIGE:A(155)=P
TTI:A(156)=RSHP
290 A(157)=STYPE:A(158)=ICESHD:A(159)=STRTIN:A(160)=INLET:
A(161)=BARR:A(162)=PARTSEP:A(163)=EAPS:A(164)=HDIF:A(165)=
INRED:A(166)=EEDS:A(167)=RSHP1:A(168)=RSHP2:A(169)=RSHP3:A
(170)=RSHP1A:A(171)=RSHP2A:A(172)=RSHP3A:A(173)=ESHP:A(174
)=LOSS:G=175
300 LL=LL+1:FOR I=1 TO LL:A(G)=O(I):G=G+1:NEXT I:G=G+1+LL:
G1=G+1+2*LL:G2=G1+1+2*LL:G3=G2+1+2*LL:G4=G3+1+2*LL
310 FOR I=1 TO 2:FOR J=1 TO LL:A(G)=PINF(I,J):A(G1)=
POF(I,J):A(G2)=PPF(I,J):A(G3)=PTF(I,J):A(G4)=TM(I,J):G=G+1
:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:NEXT J,I
320 G5=G4+2:G6=G5+2:G7=G6+2:FOR I=1 TO 2:A(G4)=PITR(I):
A(G5)=POTR(I):A(G6)=PTTR(I):A(G7)=CLTR(I):G4=G4+1:G5=G5+1:
G6=G6+1:G7=G7+1:NEXT I:G8=G7+1+2*(LL-1):G9=G8+1+2*(LL-1)
330 FOR I=1 TO 2:FOR J=2 TO LL:A(G7)=PITRF(I,J):A(G8)=
POTRF(I,J):A(G9)=PTTRF(I,J):G7=G7+1:G8=G8+1:G9=G9+1:NEXT
J,I:G10=G9+1+2*LL:G11=G10+1+2*LL:G12=G11+1+2*LL:G13=G12+1+
2*LL:G14=G13+1+2*LL
340 FOR I=1 TO 2:FOR J=1 TO LL:A(G9)=TTM(I,J):A(G10)=
TRT(I,J):A(G11)=L(I,J):A(G12)=VERSTAB(I,J):A(G13)=PTTRVSF(
I,J):A(G14)=PITRFI(I,J):G9=G9+1:G10=G10+1:G11=G11+1:G12=G1
2+1:G13=G13+1:G14=G14+1:NEXT J,I
350 G15=G14+1:G16=G15+1+2*LL:G17=G16+1+2*LL:G18=G17+1+2*
LL:G19=G18+1+2*LL:G20=G19+1+2*LL:G21=G20+1+2*LL
360 FOR I=1 TO 2:FOR J=1 TO LL:A(G15)=AL90(I,J):A(G16)=
AL270(I,J):A(G17)=M90(I,J):A(G18)=MCRIT(I,J):A(G19)=PS(I,J
):A(G20)=PM(I,J):A(G21)=PTT(I,J):G15=G15+1:G16=G16+1:G17=G
17+1:G18=G18+1:G19=G19+1:G20=G20+1:G21=G21+1:NEXT J,I
370 LL(3)=175+(46*LL):LL=LL-1
380 Z=5:OPEN "B:DATA1" FOR OUTPUT AS #1:PRINT #1, Z:FOR
I=1 TO 10:PRINT #1, LL(I):NEXT I:CLOSE #1
390 OPEN "B:DATA5" FOR OUTPUT AS #1:FOR I=1 TO LL(3):PRINT
#1, A(I):NEXT I:CLOSE #1:RETURN 120
400 '
410 '
```

```
420 '                          *** SECTION 5.3 ***
430 '
440 '
450 '
460 CLS:LOCATE 5,30,1:PRINT "*** SECTION 5.3 ***":LOCATE
7,33,1:PRINT "-BLADE TWIST-":LOCATE 10,3,1:PRINT "BLADE
TWIST IS USUALLY BETWEEN MINUS SEVEN DEGREES AND MINUS TEN
DEGREES":LOCATE 12,15,1:INPUT "ENTER YOUR SELECTION FOR
BLADE TWIST";BLTW
470 THT=BLTW*PI/180:LOCATE 23,30,1:INPUT "ANY CHANGES
(Y/N)";A$:IF A$="Y" THEN GOTO 460 ELSE IF A$="y" GOTO 460
ELSE IF A$="N" GOTO 490 ELSE IF A$="n" GOTO 490 ELSE
480 LOCATE 24,27,1:PRINT "you must enter (y/n) try
again":GOTO 470
490 IF X=16 THEN GOTO 510 ELSE RETURN 120
500 '
510 '
520 '                          *** SECTION 5.4 ***
530 '
540 '
550 CLS:LOCATE 5,30,1:PRINT "*** SECTION 5.4 ***":LOCATE
7,26,1:PRINT "-ROTOR TIP ANGLE OF ATTACK-":LOCATE
10,10,1:INPUT "ENTER STALL ANGLE OF ATTACK FOR MAIN ROTOR
BLADE SECTION";AMAX:AM=AMAX*PI/180:LOCATE 23,1,0:PRINT
"~W=COMP/"
560 MM=M:RHO(1)=RHO:BB=B:B=TIPLOSS:DA=PI*R^2:VT=OMEGA*R:
LLL=LL+1:FOR U=1 TO 2:FOR L=1 TO LLL:VF=O(L)*1.687778:IF
L=LLL THEN O(L)=O(L-1)+20
570 CT=GW(N)/(RHO(U)*DA*VT^2):B=1-(SQR(2*CT)/BB)
580 MU3=VF/VT:T1=.5*((B^2)+.5*(MU3^2)):T2=((B^3)/3)+(.5*
(MU3^2)*B):T3=((B^2)/4)*(B^2+MU3^2):T4=(.5*MU3)*((B^2)+((M
U3^2)/4)):B1=(B^2-.5*(MU3^2)):A11=4*((MU3*(B^2)/2)-
(MU3^3)/8)/((B^2)*B1):A12=(8*MU3*B)/(3*B1):A13=(2*MU3*(B^2
))/B1:A14=(B^2+(3*(MU3^2))/2)/B1
590 A14=(B^2+(3*MU3^2)/2)/B1:PPF(U,L)=RHO(U)*VF^3*
EFPA/2:IF O(L)<=40 THEN LAM=SQR(CT/2):PPF(U,L)=PPF(U,L)/
550 ELSE LAM=-(((PPF(U,L))/GW(N))+(GW(N)/(2*RHO(U)*DA
*VF)))/VT:PPF(U,L)=PPF(U,L)/550
600 F(1)=(2*CT/(SIGMA*CLALPHA))-LAM*T1-THT*T3:F(2)=-
LAM*A11-THT*A13:K(1,1)=T2:K(1,2)=T4:K(2,1)=A12:
K(2,2)=A14:H=2
610 '
620 '      SIMULTANEOUS EQUATION SOLVER USING MATRIX
630 '      DECOMPOSTION WITH FORWARD SUBSTITUTION IN LOWER
640 '      TRIANGULAR SYSTEM AND BACK-SUBSTITUTION IN UPPER
650 '      TRIANGULAR SYSTEM
660 '
670 '
680 FOR D=2 TO H:FOR I=1 TO D-1:FOR M=1 TO I-1:K(D,I)=
K(D,I)-(K(D,M)*K(M,I)):K(I,D)=K(I,D)-(K(I,M)*K(M,D)):NEXT
```

```
M:K(D,I)=K(D,I)/K(I,I):NEXT I:FOR J=1 TO D-1:K(D,D)=K(D,D)
-(K(D,J)*K(J,D)):NEXT J,D
690 FOR I=2 TO H:E=0:FOR J=1 TO I-1:G=K(I,J)*F(J):E=E+G:
NEXT J:F(I)=F(I)-E:NEXT I
700 F(H)=F(H)/K(H,H):FOR I=H-1 TO 1 STEP -1:P=0:FOR J=I+1
TO H:Q=F(J)*K(I,J):P=P+Q:NEXT J:F(I)=(F(I)-P)/K(I,I):NEXT
I:TH0=F(1):TH2=F(2)
710 AL90(U,L)=(TH0+TH2+THT+(LAM/(1+MU3)))*180/PI:AL270
(U,L)=(TH0-TH2+THT+(LAM/(1+MU3)))*180/PI:NEXT L,U:M=MM
720 FOR KK=1 TO 2:GOSUB 730:NEXT KK:IF X1=1 OR X2=1 THEN
GOTO 870 ELSE IF X=6 THEN RETURN ELSE IF X=16 THEN GOTO
810 ELSE IF PR=2 THEN GOTO 2100 ELSE IF AU=1 THEN LPRINT
CHR$ (12):GOTO 1990 ELSE GOTO 120
730 CLS:LOCATE 2,15,1:PRINT "COMPRESSIBILITY AND STALL
EFFECTS ON POWER REQUIRED":IF KK=1 THEN LOCATE
4,32,1:PRINT "STANDARD SEA LEVEL":LOCATE 5,20,1:PRINT
"ALTITUDE = 0 FT     TEMPERATURE = 59 DEG. F" ELSE
740 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F"
750 LOCATE 7,7,1:PRINT "AIRSPEED    ALPHA      ALPHA
M90      Mcrit      Ps         Pm":LOCATE 8,9,1:PRINT
"(kts)      (90)      (270)                          (shp)
(shp)"
760 A$="###.#":B$="##.###":C$="#.####":K=10:FOR L=1 TO
LL+1:LOCATE K,9,1:PRINT USING A$;O(L):LOCATE K,18,1:PRINT
USING B$;AL90(KK,L):LOCATE K,29,1:PRINT USING
B$;AL270(KK,L):LOCATE K,39,1:PRINT USING
C$;M90(KK,L):LOCATE K,49,1:PRINT USING C$;MCRIT(KK,L)
770 D$="####.#":LOCATE K,59,1:PRINT USING
D$;PS(KK,L):LOCATE K,69,1:PRINT USING
D$;PM(KK,L):K=K+1:NEXT L:B=BB:IF AU=1 THEN GOTO 780 ELSE
GOSUB 2410:RETURN
780 LCOPY:RETURN
790 '
800 '
810 '                      *** SECTION 5.5 ***
820 '
830 '
840 CLS:LOCATE 5,30,1:PRINT "*** SECTION 5.5 ***":LOCATE
7,27,1:PRINT "-STALL POWER INCREMENT-":LOCATE 23,1,0:PRINT
"~W=COMP/"
850 FOR I=1 TO 2:FOR L=1 TO LLL:ACK=AL270(I,L)-AMAX:IF
ACK<0 THEN PS(I,L)=0 ELSE PS(I,L)=(ACK/4)*POF(I,L)
860 NEXT L,I
870 FOR KK=1 TO 2:GOSUB 880:NEXT KK:IF X1=1 THEN X1=0:GOTO
1040 ELSE IF X2=1 THEN X2=0:GOTO 1120 ELSE IF X=16 GOTO
970 ELSE IF PR=3 GOTO 2100 ELSE IF AU=1 THEN LPRINT CHR$
(12):GOTO 1990 ELSE GOTO 120
```

```
880 CLS:LOCATE 2,30,1:PRINT "TOTAL POWER REQUIRED":LOCATE
3,28,1:PRINT "(With High Speed Effects)":IF KK=1 THEN
LOCATE 4,32,1:PRINT "STANDARD SEA LEVEL":LOCATE
5,20,1:PRINT "ALTITUDE = 0 FT     TEMPERATURE = 59 DEG. F"
ELSE
890 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F"
900 LOCATE 7,5,1:PRINT "AIRSPEED      Pi        Po        Pp
Ps        Pm        Ptr       PT":LOCATE 8,7,1:PRINT "(kts)
(shp)    (shp)    (shp)    (shp)    (shp)    (shp)
(shp)"
910 A$="###.#":B$="####.#":K=10:FOR L=1 TO LL+1:LOCATE
K,7,1:PRINT USING A$;O(L):LOCATE K,17,1:PRINT USING
B$;PINF(KK,L):LOCATE K,26,1:PRINT USING
B$;POF(KK,L):LOCATE K,35,1:PRINT USING B$;PPF(KK,L):LOCATE
K,44,1:PRINT USING B$;PS(KK,L)
920 PTTRF(KK,1)=PTTR(KK):LOCATE K,53,1:PRINT USING
B$;PM(KK,L):LOCATE K,62,1:PRINT USING
B$;PTTRF(KK,L):LOCATE K,72,1:PRINT USING
B$;PTT(KK,L):K=K+1:NEXT L:IF AU=1 THEN GOTO 930 ELSE GOSUB
2410:RETURN
930 LCOPY:RETURN
940 '
950 '
960 '                       *** SECTION 5.6 ***
970 '
980 '
990 CLS:LOCATE 5,30,1:PRINT "*** SECTION 5.6 ***":LOCATE
7,27,1:PRINT "-COMPRESSIBILITY EFFECTS-":LOCATE
10,24,1:INPUT "ENTER BLADE CRITICAL MACH NUMBER";CM
1000 LOCATE 12,24,0:INPUT "IS THIS A CAMBERED AIRFOIL
(Y/N)";CAM$:LOCATE 23,1,0:PRINT
"~W=COMP/":VT=OMEGA*R:DA=PI*R^2:RHO(1)=RHO
1010 M(1)=1116.89:FOR I=1 TO 2:FOR L=1 TO
LL+1:VF=O(L)*1.687778:MTIP=VT/M(I):MU3=VF/VT:M90(I,L)=MTIP
*(1+MU3):IF CAM$="N" OR CAM$="n" THEN MCRIT(I,L)=CM-(2.3*
ABS(AL90(I,L))*PI/180) ELSE MCRIT(I,L)=CM-(2.3*AL90(I,L)*
PI/180)
1020 MD=M90(I,L)-MCRIT(I,L)-.06:IF MD<0 THEN PM(I,L)=0
ELSE PM(I,L)=(((.012*MD)+.1*(MD^3))*SIGMA*RHO(I)*DA*VT^3)
/550
1030 NEXT L,I:X1=1:GOSUB 720
1040 IF X=16 THEN GOTO 1090 ELSE RETURN 120
1050 '
1060 '
```

```
1070 '                          *** SECTION 5.7 ***
1080 '
1090 '
1100 CLS:LOCATE 5,30,1:PRINT "*** SECTION 5.7 ***":LOCATE
7,28,1:PRINT "-TOTAL POWER REQUIRED-":LOCATE 23,1,0:PRINT
"~W=COMP/"
1110 FOR I=1 TO 2:FOR L=1 TO LL+1:PTT(I,L)=POF(I,L)+
PINF(I,L)+PPF(I,L)+PS(I,L)+PM(I,L)+PTTRF(I,L):NEXT
L,I:X2=1:GOSUB 870
1120 IF X=16 THEN GOTO 1150 ELSE RETURN 120
1130 '
1140 '
1150 '                         *** SECTION 5.8 ***
1160 '
1170 '
1180 CLS:LOCATE 5,30,1:PRINT "*** SECTION 5.8 ***":LOCATE
7,13,1:PRINT "-ROTOR SHAFT HORSEPOWER REQUIRED AT MAXIMUM
VELOCITY-"
1190 LOCATE 10,20,1:PRINT "TOTAL ROTOR SHAFT HORSEPOWER
REQUIRED AT:":LOCATE 12,26,1:PRINT "STANDARD SEA LEVEL
=";PTT(1,LL):LOCATE 14,26,1:PRINT "SPECIFICATION ALTITUDE
=";PTT(2,LL):GOSUB 2410:IF X=16 THEN GOTO 1240 ELSE GOTO
120
1200 '
1210 '
1220 '                         *** SECTION 5.9 ***
1230 '
1240 '
1250 CLS:LOCATE 5,30,1:PRINT "*** SECTION 5.9 ***":LOCATE
7,16,1:PRINT "-ROTOR SHAFT HORSEPOWER FOR HOVER CEILING,
IGE-":LOCATE 10,20,0:INPUT "ENTER SPECIFICATION HOVER
CEILING";ALT1:RHO(3)=RHO*(1-6.87535E-06*ALT1)^4.2561
1260 CTHC=GW(N)/(PI*RHO(3)*R^4*OMEGA^2):TIPHC=1-SQR(2*
CTHC)/B:PIHC=GW(N)^1.5/(SQR(2*RHO(3)*PI*R^2)*TIPHC*550):PO
HC=CDO*SIGMA*RHO(3)*PI*R^5*OMEGA^3/4400
1270 HH=(RH+5)/(2*R):PINIGEH=((-.1276*((HH)^4)+.708*((HH)^
3)-1.4569*((HH)^2)+1.3432*(HH)+.5147)*PIHC):PTTI=PINIGEH+
POHC+PTTRHC
1280 TRTH=PINIGEH*550/(OMEGA*TL):CTTRHC=TRTH/(PI*RHO(3)*
TR^4*OMEGAT^2):TIPTRHC=1-SQR(2*CTTRHC)/BT:DELTA=(1-
(6.87535E-06*ALT1))^5.2561:THETA=(1+(6.87535E-06*ALT1))
1290 PITRHC=TRTH^1.5/(SQR(2*RHO(3)*PI*TR^2)*TIPTRHC*550):
POTRHC=CDO*RHO(3)*PI*TR^5*SIGMAT*OMEGAT^3/4400:PTTRHC=PITR
HC+POTRHC:PTTI=(PINIGEH+POHC+PTTRHC)/(DELTA*SQR(THETA))
1300 LOCATE 12,15,1:PRINT "INDUCED POWER REQUIRED AT
SPECIFICATION ALTITUDE =";PINIGEH:LOCATE 14,15,1:PRINT
"TOTAL POWER REQUIRED AT SPECIFICATION ALTITUDE
=";PTTI:GOSUB 2410:IF X=16 THEN GOTO 1350 ELSE GOTO 120
1310 '
1320 '
```

```
1330 '                        *** SECTION 5.10 ***
1340 '
1350 '
1360 CLS:LOCATE 5,30,1:PRINT "*** SECTION 5.10 ***":LOCATE
7,19,1:PRINT "-MAXIMUM ROTOR SHAFT HORSE POWER REQUIRED-"
1370 IF PTT(1,1)>PTT(1,LL) THEN RSHP=PTT(1,1) ELSE
RSHP=PTT(1,LL)
1380 IF PTT(2,1)>RSHP THEN RSHP=PTT(2,1) ELSE RSHP=RSHP
1390 IF PTT(2,LL)>RSHP THEN RSHP=PTT(2,LL) ELSE RSHP=RSHP
1400 IF PTTI>RSHP THEN RSHP=PTTI ELSE RSHP=RSHP
1410 LOCATE 10,15,1:PRINT "MAXIMUM ROTOR SHAFT HORSE POWER
REQUIRED =";RSHP:GOSUB 2410:IF X=16 THEN GOTO 1450 ELSE
GOTO 120
1420 '
1430 '
1440 '                        *** SECTION 5.12 ***
1450 '
1460 '
1470 CLS:LOCATE 2,30,1:PRINT "*** SECTION 5.12 ***":LOCATE
4,27,1:PRINT "-INLETS AND INLET DUCTING-"
1480 LOCATE 8,27,1:PRINT "1. S-TYPE":LOCATE 10,27,1:PRINT
"2. ICE SHIELD":LOCATE 12,27,1:PRINT "3. STRAIGHT-
IN":LOCATE 14,27,1:PRINT "4. SELECTIONS COMPLETE"
1490 LOCATE 16,30,1:INPUT "WHICH SELECTION";U:IF U=1 THEN
GOTO 1510 ELSE IF U=2 GOTO 1520 ELSE IF U=3 GOTO 1530 ELSE
IF U=4 GOTO 1540 ELSE
1500 IF U<1 OR U>4 THEN GOTO 1490
1510 STYPE=.05:LOCATE 8,45,0:PRINT "*":GOTO 1490
1520 ICESHD=.1:LOCATE 10,45,0:PRINT "*":GOTO 1490
1530 STRTIN=.02:LOCATE 12,45,0:PRINT "*":GOTO 1490
1540 INLET=STYPE+ICESHD+STRTIN:PINLET=INLET*100:RSHP1=RSHP
*INLET:LOCATE 18,20,1:PRINT "PERCENT INCREASE DUE TO INLET
=";PINLET:LOCATE 20,20,1:PRINT "SHAFT HORSEPOWER REQUIRED
FOR INLETS ";RSHP1:RSHP1A=RSHP*(1+INLET)
1550 LOCATE 22,10,1:PRINT "TOTAL SHAFT HORSEPOWER REQUIRED
WITH INLETS INCLUDED =";RSHP1A:GOSUB 2410:IF X=16 THEN
GOTO 1600 ELSE GOTO 120
1560 '
1570 '
1580 '                      *** SECTION 5.13 ***
1590 '
1600 '
1610 CLS:LOCATE 2,30,1:PRINT "*** SECTION 5.13 ***":LOCATE
4,25,1:PRINT "-ENGINE AIR PARTICLE SEPARATORS-"
1620 LOCATE 8,25,1:PRINT "1. BARRIER":LOCATE 10,25,1:PRINT
"2. PARTICLE SEPARATOR":LOCATE 12,25,1:PRINT "3. SELECTION
COMPLETE"
1630 LOCATE 14,30,1:INPUT "WHICH SELECTION";U:IF U=1 THEN
GOTO 1650 ELSE IF U=2 GOTO 1660 ELSE IF U=3 GOTO 1670 ELSE
1640 IF U<1 OR U>3 THEN GOTO 1630
1650 BARR=.1:LOCATE 8,45,0:PRINT "*":GOTO 1630
```

```
1660 LOCATE 10,50,0:INPUT
"PERCENT";PS:PARTSEP=PS*.01:LOCATE 10,47,0:PRINT "*":GOTO
1630
1670 EAPS=BARR+PARTSEP:PEAPS=EAPS*100:RSHP2=EAPS*RSHP1A:
LOCATE 16,20,1:PRINT "PERCENT INCREASE DUE TO EAPS
=";PEAPS:LOCATE 18,20,1:PRINT "SHAFT HORSEPOWER REQUIRED
FOR EAPS =";RSHP2:RSHP2A=RSHP1A*(1+EAPS)
1680 LOCATE 20,10,1:PRINT "TOTAL SHAFT HORSEPOWER REQUIRED
WITH INLETS & EAPS =";RSHP2A:GOSUB 2410:IF X=16 THEN GOTO
1720 ELSE GOTO 120
1690 '
1700 '
1710 '                     *** SECTION 5.14 ***
1720 '
1730 '
1740 CLS:LOCATE 2,30,1:PRINT "*** SECTION 5.14 ***":LOCATE
4,27,1:PRINT "-ENGINE EXHAUST DIFFUSERS-"
1750 LOCATE 8,25,1:PRINT "1. HEAT DIFFUSER":LOCATE
10,25,1:PRINT "2. INFRA-RED SUPPRESSER":LOCATE
12,25,1:PRINT "3. SELECTION COMPLETE"
1760 LOCATE 14,30,1:INPUT "WHICH SELECTION";U:IF U=1 THEN
GOTO 1780 ELSE IF U=2 GOTO 1790 ELSE IF U=3 GOTO 1800 ELSE
1770 IF U<1 OR U>3 THEN GOTO 1760
1780 HDIF=.03:LOCATE 8,50,0:PRINT "*":GOTO 1760
1790 INRED=.05:LOCATE 10,50,0:PRINT "*":GOTO 1760
1800 IF RSHP2A=0 THEN RSHP2A=RSHP1A
1810 EEDS=HDIF+INRED:PEEDS=EEDS*100:RSHP3=RSHP2A*EEDS:
LOCATE 16,20,1:PRINT "PERCENT INCREASE DUE TO EEDS
=";PEEDS:LOCATE 18,20,1:PRINT "SHAFT HORSEPOWER REQUIRED
FOR EEDS =";RSHP3:RSHP3A=RSHP2A*(1+EEDS)
1820 LOCATE 20,10,1:PRINT "TOTAL SHAFT HORSEPOWER REQUIRED
WITH INLETS, EAPS & EEDS =";RSHP3A:GOSUB 2410:IF X=16 THEN
GOTO 1870 ELSE GOTO 120
1830 '
1840 '
1850 '                      *** SECTION 5.15 ***
1860 '
1870 '
1880 CLS:LOCATE 5,30,1:PRINT "*** SECTION 5.15 ***":LOCATE
7,22,1:PRINT "-ENGINE SHAFT HORSE POWER REQUIRED-
":LOSS1=RSHP
1890 IF RSHP1A>0 THEN LOSS1=RSHP1A
1900 IF RSHP2A>0 THEN LOSS1=RSHP2A
1910 IF RSHP3A>0 THEN LOSS1=RSHP3A
1920 IF ENGINE=1 THEN GOT 1670 ELSE IF ENGINE=2 GOTO 1940
ELSE IF ENGINE=3 GOTO 1950
1930 LOSS=LOSS1*1.03:GOTO 1960
1940 LOSSA=LOSS1*1.1:LOSS=LOSSA*1.03:GOTO 1960
1950 LOSSA=LOSS1*1.15:LOSSB=LOSSA*1.03:LOSS=LOSSB*1.01333
33#:GOTO 1960
```

```
1960 ESHP=LOSS+10:LOCATE 10,18,1:PRINT "ENGINE SHAFT
HORSEPOWER REQUIRED =";ESHP:GOSUB 2410:RETURN 120
1970 '                            *** PRINT OUT DATA ***
1980 '
1990 '
2000 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C5PRINT/":INPUT;"",RR:COLOR 15,1,1
2010 AU=0:ON RR GOTO 2030,2030,2030,2020
2020 RETURN 120
2030 CLS:LOCATE 23,1,0:PRINT "~W=PRINTER/":GOSUB 2410:ON
RR GOTO 2040,2050,2060
2040 AU=1:GOSUB 2140
2050 AU=1:GOSUB 720
2060 AU=1:GOSUB 870
2070 '
2080 '
2090 '                            *** LIST RESULTS ***
2100 '
2110 '
2120 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C5RESULT/":INPUT;"",PR:COLOR 15,1,1
2130 AU=0:IF PR=1 THEN GOTO 2140 ELSE IF PR=2 THEN GOSUB
720 ELSE IF PR=3 THEN GOSUB 870 ELSE IF PR=4 THEN RETURN
120
2140 CLS:LOCATE 1,25,1:PRINT "TABLE OF CHAPTER FIVE
RESULTS"
2150 STYPEA=STYPE*100:ICESHA=ICESHD*100:STRTINA=STRTIN*100
:BARRA=BARR*100:PARTSEPA=PARTSEP*100:HDIFA=HDIF*100:INREDA
=INRED*100
2160 LOCATE 3,12,1:PRINT "BLADE TWIST";TAB(57) BLTW
2170 PRINT TAB(12) "BLADE STALL ANGLE OF ATTACK";TAB(57)
AMAX
2180 PRINT TAB(12) "BLADE Mcrit";TAB(57) CM
2190 PRINT TAB(12) "BLADE LIFT CURVE SLOPE";TAB(57)
CLALPHA
2200 PRINT TAB(12) "BLADE Cdo";TAB(57) CDO
2210 PRINT TAB(12) "RSHP REQUIRED AT MAXIMUM VELOCITY:"
2220 PRINT TAB(17) "SPECIFICATION ALTITUDE";TAB(57)
PTT(2,LL)
2230 PRINT TAB(17) "STANDARD SEA LEVEL";TAB(57) PTT(1,LL)
2240 PRINT TAB(12) "RSHP FOR HOVER CEILING, IGE";TAB(57)
PTTI
2250 PRINT TAB(12) "MAXIMUM RSHP";TAB(57) RSHP
2260 PRINT TAB(12) "INLETS AND INLET DUCTING LOSSES:"
2270 PRINT TAB(17) "S-TYPE";TAB(57) STYPEA;"%"
2280 PRINT TAB(17) "ICE SHEILD";TAB(57) ICESHDA;"%"
2290 PRINT TAB(17) "STRAIGHT IN";TAB(57) STRTINA;"%"
2300 PRINT TAB(12) "ENGINE AIR PARTICLE SEPARATORS:"
2310 PRINT TAB(17) "BARRIER";TAB(57) BARRA;"%"
2320 PRINT TAB(17) "PARTICLE SEPARATOR";TAB(57)
PARTSEPA;"%"
```

```
2330 PRINT TAB(12) "ENGINE EXHAUST DIFFUSERS:"
2340 PRINT TAB(17) "HEAT DIFFUSERS";TAB(57) HDIFA;"%"
2350 PRINT TAB(12) "INFRA-RED SUPPRESSER DIFFUSER";TAB(57)
INREDA;"%"
2360 PRINT TAB(12) "ENGINE SHAFT HORSEPOWER
REQUIRED";TAB(57) ESHP
2370 IF AU=1 THEN GOTO 2380 ELSE GOSUB 2410:RETURN 2120
2380 LCOPY:LPRINT CHR$ (12):GOSUB 2410:RETURN 2000
2390 '
2400 '
2410 IF AP=1 THEN LOCATE 25,79,0 ELSE LOCATE 25,27,0:PRINT
"press any key to continue"
2420 A$=INKEY$:IF A$="" THEN 2420
2430 RETURN
```

```
10 '****************** CHAPTER FIVE **********************
20 '
30 '              BLADE SELECTION OPTIMIZATION
40 '
50 '*****************************************************
60 '
70 '
80 '                  *** DATA INPUT ***
90 '
100 '
110 CLS:LOCATE 3,25,1:PRINT "*** BLADE SELECTION
OPTIMIZATION ***":LOCATE 10,15,1:INPUT "NUMBER OF BLADES
YOU WISH TO CHECK (MAX 5 AT A TIME)";V1:CLS:LOCATE
10,15,1:PRINT "DO YOU WANT TABULAR OUTPUT OF ALL THE
PARAMETERS AT EACH"
120 LOCATE 11,15,1:INPUT "ANGLE OF TWIST AS IT IS
CALCULATED (Y/N)";A$:IF A$="Y" THEN GOTO 140 ELSE IF
A$="y" GOTO 140 ELSE IF A$="N" THEN AO=1:GOTO 140 ELSE IF
A$="n" THEN AO=1:GOTO 140 ELSE
130 GOTO 120
140 CLS:LOCATE 10,30,0:PRINT "ENTER BLADE TWIST
RANGE":LOCATE 12,32,0:INPUT "MINIMUM (ie. -7)";ALMN:LOCATE
14,32,0:INPUT "MAXIMUM (ie. -15)";ALMX
150 W=0:CLS:LOCATE 2,25,1:PRINT "*** BLADE SELECTION
OPTIMIZATION ***":LOCATE 5,1,0:PRINT "BLADE       NAME
CLÁ      STALLÁ      Cdo      Mcrit      CAMBERED
(Y/N)":FOR U=1 TO 80:LOCATE 6,U,0:PRINT "ë":NEXT U:KK=7
160 FOR I=1 TO V1
170 LOCATE KK,2,0:PRINT I:LOCATE KK,9,0:INPUT
"",A$(I):LOCATE KK,26,0:INPUT "",CLALPHA1(I):LOCATE
KK,37,0:INPUT "",STAL(I):LOCATE KK,47,0:INPUT
"",CDO1(I):LOCATE KK,56,O:INPUT "",CM(I):LOCATE
KK,72,0:INPUT "",CAM$(I):KK=KK+1
180 FOR U=1 TO 80:LOCATE KK,U,0:PRINT "-":NEXT U:KK=KK+1
190 LOCATE 23,25,1:INPUT "ANY CHANGES FOR THIS LINE
(Y/N)";A$:IF A$="Y" THEN GOSUB 210:GOSUB 220:GOTO 170 ELSE
IF A$="y" THEN GOSUB 210:GOSUB 220:GOTO 170 ELSE IF A$="N"
OR A$="n" THEN GOSUB 210:NEXT I
200 GOTO 230
210 LOCATE 23,25,0:PRINT "
":RETURN
220 KK=KK-2:LOCATE KK,1,0:PRINT "
":RETURN
230 LOCATE 23,1,0:PRINT "~W=COMP/":GOTO 250
240 '
250 MM=M:BB=B:B=TIPLOSS:FOR Z=1 TO V1:W=0
260
CLALPHA1=CLALPHA1(Z):STAL=STAL(Z):AM=STAL*PI/180:CDO1=CDO1
(Z):CM=CM(Z):CAM$=CAM$(Z)
270 '
```

```
280 LLL=LL+1:FOR I=1 TO 2:FOR J=1 TO LLL:POFA(I,J)=
POF(I,J):PPFA(I,J)=PPF(I,J):PTFA(I,J)=PTF(I,J):PITRFA(I,J)
=PITRF(I,J):POTRFA(I,J)=POTRF(I,J):PTTRFA(I,J)=PTTRF(I,J):
NEXT J,I
290 RHO(1)=RHO:DA=PI*R^2:VT=OMEGA*R:TRA=PI*TR^2:LLL=LL+
1:FOR U=I TO 2:L=LL
300 VF=1.687778*O(L):MU2=VF/(OMEGA*R):VITR=SQR((-(VF^2)/2)
+SQR((((VF^2)/2)^2)+((PTF(U,L)*550)^2)/((2*TRA*RHO(U)*TL*O
MEGA)^2))):PITRF(U,L)=(((PTF(U,L)*550)/(TL*OMEGA))*VITR)/(
550*TB(U))
310 POTRF(U,L)=SIGMAT*CD01*RHO(U)*TRA*((OMEGAT*TR)^3)*(1+
(4.3*(MU2^2)))/4400:PTTRF(U,L)=PITRF(U,L)+POTRF(U,L)
320 NEXT U
330 FOR I=1 TO 2:PTTRF(I,1)=PTTR(I):NEXT I
340 '
350 FOR EE=ALMN TO ALMX STEP -1:THT=EE*PI/180:W=ABS(EE)
360 M(1)=1116.89:FOR U=1 TO 2:L=LL:VF=O(L)*1.687778
370 CT=GW(N)/(RHO(U)*DA*VT^2)
380 B=1-(SQR(2*CT)/BB)
390 MU3=VF/VT:T1=.5*((B^2)+.5*(MU3^2)):T2=((B^3)/3)+(.5*
(MU3^2)*B):T3=((B^2)/4)*(B^2+MU3^2):T4=(.5*MU3)*((B^2)+((M
U3^2)/4)):B1=(B^2-.5*(MU3^2)):A11=4*((MU3*(B^2)/2)-(MU3^3)
/8)/((B^2)*B1):A12=(8*MU3*B)/(3*B1):A13=(2*MU3*(B^2))/B1:A
14=(B^2+(3*(MU3^2))/2)/B1
400 A14=(B^2+(3*MU3^2)/2)/B1:PPF(U,L)=RHO(U)*VF^3*EFPA/2:
IF O(L)<=40 THEN LAM=SQR(CT/2):PPF(U,L)=PPF(U,L)/550 ELSE
LAM=-(((PPF(U,L))/GW(N))+(GW(N)/(2*RHO(U)*DA*VF)))/VT:
PPF(U,L)=PPF(U,L)/550
410 F(1)=(2*CT/(SIGMA*CLALPHA1))-LAM*T1-THT*T3:F(2)=-
LAM*A11-THT*A13:K(1,1)=T2:K(1,2)=T4:K(2,1)=A12:
K(2,2)=A14:H=2
420 '
430 '     SIMULTANEOUS EQUATION SOLVER USING MATRIX
440 '     DECOMPOSTION WITH FORWARD SUBSTITUTION IN LOWER
450 '     TRIANGULAR SYSTEM AND BACK-SUBSTITUTION IN UPPER
460 '     TRIANGULAR SYSTEM
470 '
480 '
490 FOR D=2 TO H:FOR I=1 TO D-1:FOR M=1 TO I-1:K(D,I)=
K(D,I)-(K(D,M)*K(M,I)):K(I,D)=K(I,D)-(K(I,M)*K(M,D)):NEXT
M:K(D,I)=K(D,I)/K(I,I):NEXT I:FOR J=1 TO D-1:K(D,D)=
K(D,D)-(K(D,J)*K(J,D)):NEXT J,D
500 FOR I=2 TO H:E=0:FOR J=1 TO I-1:G=K(I,J)*F(J):E=E+G:
NEXT J:F(I)=F(I)-E:NEXT I
510 F(H)=F(H)/K(H,H):FOR I=H-1 TO 1 STEP -1:P=0:FOR J=I+1
TO H:Q=F(J)*K(I,J):P=P+Q:NEXT J:F(I)=(F(I)-P)/K(I,I):NEXT
I:TH0=F(1):TH2=F(2):FOR I=1 TO 2:F(I)=0:FOR J=1 TO
2:K(I,J)=0:NEXT J,I
520 AL90(U,L)=(TH0+TH2+THT+(LAM/(1+MU3)))*180/PI:AL270
(U,L)=(TH0-TH2+THT+(LAM/(1+MU3)))*180/PI
530 '
```

```
540 ACK=AL270(U,L)-STAL(Z):IF ACK<0 THEN PS(U,L)=0 ELSE
PS(U,L)=(ACK/4)*POF(U,L)
550 '
560 '
570 MTIP=VT/M(U):MU3=VF/VT:M90(U,L)=MTIP*(1+MU3):IF
CAM$="N" OR CAM$="n" THEN MCRIT(U,L)=CM-(2.3*ABS(AL90
(U,L))*PI/180) ELSE MCRIT(U,L)=CM-(2.3*AL90(U,L)*PI/180)
580 MD=M90(U,L)-MCRIT(U,L)-.06:IF MD<0 THEN PM(U,L)=0 ELSE
PM(U,L)=(((.012*MD)+.1*(MD^3))*SIGMA*RHO(U)*DA*VT^3)/550
590 '
600 '
610
PTT(U,L)=POF(U,L)+PINF(U,L)+PPF(U,L)+PS(U,L)+PM(U,L)+PTTRF
(U,L)
620 '
630 '
640 NEXT U:IF AO=1 THEN GOTO 660 ELSE GOSUB 990
650 GOSUB 1070
660 '
670 IF PTT(1,LL)>PTT(2,LL) THEN RSHP=PTT(1,LL) ELSE
RSHP=PTT(2,LL)
680 I=ABS(EE):RSHP(Z,I)=RSHP
690 NEXT EE
700 NEXT Z
710 '
720 '
730 '
740 IF AO=1 THEN FOR I=1 TO 3:SOUND 700,9:SOUND 500,9:NEXT
I
750 CLS:LOCATE 2,22,0:PRINT "BLADE MAXIMUM VELOCITY POWER
REQUIREMENTS":LOCATE 4,40,0:PRINT "BLADES":LOCATE
5,16,0:PRINT "1             2             3             4
5":LOCATE 6,1,0:PRINT "TWIST":LOCATE 6,12,0:PRINT A$(1)
760 LOCATE 6,26,0:PRINT A$(2):LOCATE 6,40,1:PRINT
A$(3):LOCATE 6,54,0:PRINT A$(4):LOCATE 6,68,0:PRINT A$(5)
770 K=8:KK=12:FOR EE=ALMN TO ALMX STEP -1:I=ABS(EE):LOCATE
K,2,0:PRINT EE:FOR J=1 TO V1:LOCATE K,KK,0:PRINT
RSHP(J,I):KK=KK+14:NEXT J:K=K+1:KK=12
780 NEXT EE:IF AP=1 THEN AP=0:LCOPY:LPRINT CHR$ (12):GOTO
820 ELSE GOSUB 1170
790 CLS:LOCATE 10,10,0:INPUT "DO YOU WANT A HARD COPY OF
THIS TABLE (Y,N)";B$:IF B$="Y" THEN AP=1:GOTO 810 ELSE IF
B$="y" THEN AP=1:GOTO 810 ELSE IF B$="N" THEN GOTO 820
ELSE IF B$="n" THEN GOTO 820 ELSE
800 LOCATE 25,27,0:PRINT "you must enter (y/n) try
again":GOTO 790
810 CLS:PRINT "~W=PRINTER/":GOSUB 1170:GOTO 750
820 CLS:LOCATE 10,10,0:INPUT "IS THE SELECTED BLADE THE
SAME AS YOUR ORIGINAL SELECTION (Y/N)";B$:IF B$="Y" THEN
GOTO 950 ELSE IF B$="y" GOTO 950 ELSE IF B$="N" GOTO 840
ELSE IF B$="n" GOTO 840 ELSE
```

```
830 GOTO 820
840 LOCATE 14,10,1:INPUT "ENTER Cdo OF THE NEW
BLADE";CDO:LOCATE 16,10,0:PRINT "THE MAIN AND TAIL ROTOR
POWER CALCULATIONS HAVE BEEN MODIFIED":LOCATE
17,10,0:PRINT "TO REFLECT THE NEW BLADE SELECTION.
CHAPTER FOUR SECTION 4.4"
850 LOCATE 18,10,1:PRINT "THE VERTICAL STABILIZER WILL
NEED TO BE CHECKED DUE TO THE":LOCATE 19,10,0:PRINT "POWER
ALTERATIONS.  THIS CAN BE DONE AT ANY TIME, JUST
ENSURE":LOCATE 20,10,0:PRINT "CHAPTER 5 DATA IS LOADED
PRIOR TO SELECTING CHAPTER FOUR"
860 GOSUB 1170:LOCATE 23,36,0:PRINT "COMPUTING"
870 '
880 RHO(1)=RHO:DA=PI*R^2:VT=OMEGA*R:TRA=PI*TR^2:LLL=LL+1
:FOR U=I TO 2:FOR L=1 TO LLL
890 VF=O(L)*1.687778:MU3=VF/VT:POF(U,L)=SIGMA*CD01*RHO(U)
*DA*VT^3*(1+4.3*(MU3^2)):PTF(U,L)=PINF(U,L)+POF(U,L)+PPF(U
,L)
900 TTR=(((PT*550)/OMEGA)/TL):CTTR=TTR/(PI*(TR^4)*RHO(U)*
(OMEGAT^1.5)):TRB=1-((SQR(2*CTTR)/BT)):PITR(U)
=(((TTR^1.5)/SQR(2*PI*(TR^2)*RHO(U)))/TRB)/550:SIGMAT=(BT*
TRC)/(PI*TR):POTR(U)=(SIGMAT*CD01*RHO(U)*PI*(TR^5)*OMEGAT^
3)/4400:PTTR(U)=PITR(U)+POTR(U)
910 VF=1.687778*O(L):MU2=VF/(OMEGA*R):VITR=SQR((-(VF^2)/2)
+SQR((((VF^2)/2)^2)+((PTF(U,L)*550)^2)/((2*TRA*RHO(U)*TL*O
MEGA)^2))):PITRF(U,L)=(((PTF(U,L)*550)/(TL*OMEGA))*VITR)/5
50:POTRF(U,L)=SIGMAT*CD01*RHO(U)*TRA*((OMEGAT*TR)^3)*(1+(4
.3*(MU2^2)))/4400
920 PTTRF(U,L)=PITRF(U,L)+POTRF(U,L):PTTRF(U,1)=PTTR(U)
930 NEXT L,U:GOTO 960
940 '
950 LLL=LL+1:FOR I=1 TO 2:FOR J=1 TO
LLL:POF(I,J)=POFA(I,J):PPF(I,J)=PPFA(I,J):PTF(I,J)=PTFA(I,
J):PITRF(I,J)=PITRFA(I,J):POTRF(I,J)=POTRFA(I,J):PTTRF(I,J
)=PTTRFA(I,J):NEXT J,I
960 CLS:LOCATE 10,10,1:PRINT "NOW COMPLETE CHAPTER FIVE
WITH THESE BLADE SELECTION RESULTS":GOSUB 1170
970 M=MM:B=BB:FOR I=1 TO 2:FOR J=1 TO
LLL:PS(I,J)=0:PM(I,J)=0:PTT(I,J)=0:M90(I,J)=0:MCRIT(I,J)=0
:NEXT J,I
980 CHAIN "CHAP5",,ALL
990 FOR KK=1 TO 2:GOSUB 1000:NEXT KK:RETURN 650
1000 CLS:LOCATE 2,15,1:PRINT "COMPRESSIBILITY AND STALL
EFFECTS ON POWER REQUIRED":LOCATE 3,33,1:PRINT "BLADE
TWIST =";EE:IF KK=1 THEN LOCATE 4,32,1:PRINT "STANDARD SEA
LEVEL":LOCATE 5,20,1:PRINT "ALTITUDE = 0 FT
TEMPERATURE = 59 DEG. F" ELSE
1010 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F"
```

```
1020 LOCATE 7,7,1:PRINT "AIRSPEED    ALPHA      ALPHA
M90      Mcrit      Ps         Pm":LOCATE 8,9,1:PRINT
"(kts)      (90)      (270)                         (shp)
(shp)"
1030 A$="###.#":B$="##.###":C$="#.####":K=10:L=LL:LOCATE
K,9,1:PRINT USING A$;O(L):LOCATE K,18,1:PRINT USING
B$;AL90(KK,L):LOCATE K,29,1:PRINT USING
B$;AL270(KK,L):LOCATE K,39,1:PRINT USING
C$;M90(KK,L):LOCATE K,49,1:PRINT USING C$;MCRIT(KK,L)
1040 D$="####.#":LOCATE K,59,1:PRINT USING
D$;PS(KK,L):LOCATE K,69,1:PRINT USING
D$;PM(KK,L):K=K+1:GOSUB 1170:RETURN
1050 '
1060 '
1070 FOR KK=1 TO 2:GOSUB 1080:NEXT KK:LOCATE 23,1,0:PRINT
"~W=COMP/":RETURN 660
1080 CLS:LOCATE 2,30,1:PRINT "TOTAL POWER REQUIRED":LOCATE
3,28,1:PRINT "(With High Speed Effects)":IF KK=1 THEN
LOCATE 4,32,1:PRINT "STANDARD SEA LEVEL":LOCATE
5,20,1:PRINT "ALTITUDE = 0 FT     TEMPERATURE = 59 DEG. F"
1090 LOCATE 6,33,1:PRINT "BLADE TWIST =";EE ELSE
1100 IF KK=2 THEN LOCATE 4,30,1:PRINT "SPECIFICATION
ALTITUDE":LOCATE 5,18,1:PRINT "ALTITUDE =";ALT:LOCATE
5,35,1:PRINT "FT     TEMPERATURE =";TEMP:LOCATE
5,60,1:PRINT "DEG. F":LOCATE 6,33,1:PRINT "BLADE TWIST
=";EE
1110 LOCATE 7,5,1:PRINT "AIRSPEED      Pi        Po
Pp        Ps        Pm        Ptr        PT":LOCATE
8,7,1:PRINT "(kts)       (shp)    (shp)    (shp)    (shp)
(shp)    (shp)     (shp)"
1120 A$="###.#":B$="####.#":K=10:L=LL:LOCATE K,7,1:PRINT
USING A$;O(L):LOCATE K,17,1:PRINT USING
B$;PINF(KK,L):LOCATE K,26,1:PRINT USING
B$;POF(KK,L):LOCATE K,35,1:PRINT USING B$;PPF(KK,L):LOCATE
K,44,1:PRINT USING B$;PS(KK,L)
1130 PTTRF(KK,1)=PTTR(KK):LOCATE K,53,1:PRINT USING
B$;PM(KK,L):LOCATE K,62,1:PRINT USING
B$;PTTRF(KK,L):LOCATE K,72,1:PRINT USING
B$;PTT(KK,L):K=K+1:GOSUB 1170:RETURN
1140 '
1150 '
1160 '
1170 LOCATE 25,27,0:PRINT "press any key to continue"
1180 A$=INKEY$:IF A$="" THEN 1180
1190 RETURN
```

H. CHAPTER SIX

```
5 KEY(5) OFF
10 '*****************************************************
20 '
30 '                    ENGINE SELECTION
40 '
50 '*****************************************************
60 '
70 '          ***  CHAPTER SIX MAIN PROGRAM  ***
80 '
90 '
100 PRINT "~C=ALL/":PRINT "~L=CH6/"
110 KEY(9) ON:ON KEY(9) GOSUB 120
120 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C6MAIN/":INPUT;"",X
130 COLOR 15,1,1:IF X=1 THEN GOSUB 490 ELSE IF X=2 THEN
GOSUB 590 ELSE IF X=3 THEN GOSUB 800 ELSE IF X=4 THEN
GOSUB 960 ELSE IF X=5 THEN GOSUB 1150 ELSE IF X=6 THEN
GOSUB 1250 ELSE IF X=7 THEN GOSUB 490 ELSE
140 IF X=8 THEN GOSUB 1480 ELSE IF X=9 THEN GOSUB 1400
ELSE IF X=10 THEN GOSUB 210 ELSE IF X=11 THEN LOCATE
23,1,0:CLS:PRINT "~W=LOAD/":CHAIN "HD1",,ALL
150 LOCATE 23,54,1:PRINT "                    ":GOTO 130
160 '
170 '
180 '                    *** STORE DATA ON FILE DISK ***
190 '
200 '
210 CLS:LOCATE 23,1,0:PRINT "~W=DISK/":GOSUB 1800:LOCATE
25,27,1:PRINT "                            ":LOCATE
23,1,0:PRINT "~W=SAVE/"
220 A(1)=SGW:A(2)=GW1:A(3)=WE:A(4)=VTIPMAX:A(5)=R:A(6)=
OMEGA:A(7)=CT:A(8)=SIGMA:A(9)=B:A(10)=C:A(11)=AR:A(12)=CL:
A(13)=CLALPHA:A(14)=CDO:A(15)=DL:A(16)=MBL:A(17)=MU:A(18)=
MAXFVEL:A(19)=TIPLOSS:A(20)=PIN:A(21)=PO:A(22)=PT:A(23)=HP
:A(24)=PERINDP
230 V=24:FOR I=1 TO 3:FOR J=1 TO 15:V=V+1:Q=J+24:A(V)=W(Q-
24,I):NEXT J,I:FOR I=1 TO 3:A(I+69)=W2A(I):A(I+72)=W2B(I):
A(I+75)=W6A(I):A(I+78)=W6B(I):A(I+81)=W6C(I):NEXT
I:A(85)=N:A(86)=WE(N):A(87)=GW(N):A(88)=DL(N-
1):A(89)=FM(N-1):A(90)=FL:A(91)=IRLG
240 A(92)=NW
250 A(93)=PERDIFW:A(94)=PERDIFP:A(95)=Y:A(96)=FUEL:A(97)=
PEOPLE:A(98)=UL:A(99)=SPECIAL:A(100)=ENGINE:A(101)=ZZ:A(10
2)=AB:A(103)=GR:A(104)=RH:A(105)=H:A(106)=D:A(107)=PINI:A(
108)=PTI:A(109)=M:A(110)=EFPA:A(111)=RHO(2):A(112)=MM:A(11
3)=M(2):A(114)=CRUISEV
260 A(115)=CRU:A(116)=CRU2:A(117)=MAXF:A(118)=MAXF2:A(119)
=MAXCRU1:A(120)=ALT:A(121)=TEMP:A(122)=LL:A(123)=TR:A(124)
=TRPM:A(125)=OMEGAT:A(126)=TCDO:A(127)=BT:A(128)=TAR:A(129
)=TRC:A(130)=TTR:A(131)=CTTR:A(132)=TRB:A(133)=SIGMAT:A(13
4)=V:A(135)=SPAN
270 A(136)=S:A(137)=SWP:A(138)=SWEEP:A(139)=LAVS:A(140)=
VSAR:A(141)=BETA2:A(142)=T:A(143)=T2:A(144)=T3:A(145)=CLAT
R:A(146)=ALTR:A(147)=ALTRDEG:A(148)=TL:A(149)=BLTW:A(150)=
CM:A(151)=THT:A(152)=AM:A(153)=AMAX:A(154)=PINIGE:A(155)=P
TTI:A(156)=RSHP
280 A(157)=STYPE:A(158)=ICESHD:A(159)=STRTIN:A(160)=INLET:
A(161)=BARR:A(162)=PARTSEP:A(163)=EAPS:A(164)=HDIF:A(165)=
INRED:A(166)=EEDS:A(167)=RSHP1:A(168)=RSHP2:A(169)=RSHP3:A
(170)=RSHP1A:A(171)=RSHP2A:A(172)=RSHP3A:A(173)=ESHP:A(174
)=LOSS:A(175)=ENG
290 A(176)=EN:A(177)=TRPWR:A(178)=TRWT:A(179)=NGW:A(180)=
NPT:A(181)=NDL:A(182)=NFM:A(183)=NPERINDP:A(184)=NPERDIFP:
A(185)=NPERDIFW:G=186
300 LL=LL+1:FOR I=1 TO LL:A(G)=O(I):G=G+1:NEXT I:G=G+1+LL:
G1=G+1+2*LL:G2=G1+1+2*LL:G3=G2+1+2*LL:G4=G3+1+2*LL
310 FOR I=1 TO 2:FOR J=1 TO LL:A(G)=PINF(I,J):A(G1)=
POF(I,J):A(G2)=PPF(I,J):A(G3)=PTF(I,J):A(G4)=TM(I,J):G=G+1
:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:NEXT J,I
320 G5=G4+2:G6=G5+2:G7=G6+2:FOR I=1 TO 2:A(G4)=PITR(I):
A(G5)=POTR(I):A(G6)=PTTR(I):A(G7)=CLTR(I):G4=G4+1:G5=G5+1:
G6=G6+1:G7=G7+1:NEXT I:G8=G7+1+2*(LL-1):G9=G8+1+2*(LL-1)
330 FOR I=1 TO 2:FOR J=2 TO LL:A(G7)=PITRF(I,J):A(G8)=
POTRF(I,J):A(G9)=PTTRF(I,J):G7=G7+1:G8=G8+1:G9=G9+1:NEXT
J,I:G10=G9+1+2*LL:G11=G10+1+2*LL:G12=G11+1+2*LL:G13=G12+1+
2*LL:G14=G13+1+2*LL
340 FOR I=1 TO 2:FOR J=1 TO LL:A(G9)=TTM(I,J):A(G10)=
TRT(I,J):A(G11)=L(I,J):A(G12)=VERSTAB(I,J):A(G13)=PTTRVSF(
I,J):A(G14)=PITRFI(I,J):G9=G9+1:G10=G10+1:G11=G11+1:G12=G1
2+1:G13=G13+1:G14=G14+1:NEXT J,I
350 G15=G14+1:G16=G15+1+2*LL:G17=G16+1+2*LL:G18=G17+1+
2*LL: G19=G18+1+2*LL:G20=G19+1+2*LL:G21=G20+1+2*LL
360 FOR I=1 TO 2:FOR J=1 TO LL:A(G15)=AL90(I,J):A(G16)=
AL270(I,J):A(G17)=M90(I,J):A(G18)=MCRIT(I,J):A(G19)=PS(I,J
):A(G20)=PM(I,J):A(G21)=PTT(I,J):G15=G15+1:G16=G16+1:G17=G
17+1:G18=G18+1:G19=G19+1:G20=G20+1:G21=G21+1:NEXT J,I
370 G22=G21+1:G23=G22+1+ENG:G24=G23+1+ENG:G25=G24+1+ENG:
G26=G25+1+ENG:G27=G26+1+ENG:G28=G27+1+ENG:G29=G28+1+ENG:G3
0=G29+1+ENG:G31=G30+1+ENG:G32=G31+1+ENG:G33=G32+1+ENG:G34=
G33+1+ENG:G35=G34+1+ENG:G36=G35+1+ENG:G37=G36+1+ENG:G38=G3
7+1+ENG
380 G39=G38+1+ENG:G40=G39+1+ENG:G41=G40+1+ENG
390 FOR I=1 TO ENG:A(G22)=DW(I):A(G23)=SHP(I):A(G24)=
SFC(I):A(G25)=IC(I):A(G26)=OC(I):A(G27)=PMA(I):A(G28)=MTBM
A(I):A(G29)=MDT(I):A(G30)=MTBF(I):A(G31)=MTBR(I):A(G32)=RC
(I):A(G33)=SV(I):A(G34)=AVAIL(I):A(G35)=RELY(I):A(G36)=MAI
NT(I)
400 A(G37)=LC(I):A(G38)=EWT(I):A(G39)=YO(I):A(G40)=YM(I):
A(G41)=NRPL(I):G22=G22+1:G23=G23+1:G24=G24+1:G25=G25+1:G26
```

```
=G26+1:G27=G27+1:G28=G28+1:G29=G29+1:G30=G30+1:G31=G31+1:G
32=G32+1:G33=G33+1:G34=G34+1:G35=G35+1:G36=G36+1
410 G37=G37+1:G38=G38+1:G39=G39+1:G40=G40+1:G41=G41+1:NEXT
I
420 LL(4)=187+(46*LL)+(50*ENG):LL=LL-1
430 Z=6:OPEN "B:DATA1" FOR OUTPUT AS #1:PRINT #1, Z:FOR
I=1 TO 10:PRINT #1, LL(I):NEXT I:CLOSE #1
440 OPEN "B:DATA6" FOR OUTPUT AS #1:FOR I=1 TO LL(4):PRINT
#1, A(I):NEXT I:CLOSE #1:RETURN 110
450 '
460 '
470 '                      *** SECTION 6.1 ***
480 '
490 '
500 '
510 CLS:LOCATE 5,30,1:PRINT "*** SECTION 6.1 ***":LOCATE
7,30,1:PRINT "-NUMBER OF ENGINES-":LOCATE 10,22,1:INPUT
"ENTER NUMBER OF ENGINES REQUIRED";ENGINE:LOCATE
12,22,1:PRINT "NUMBER OF ENGINES =";ENGINE
520 LOCATE 23,30,1:INPUT "ANY CHANGES (Y/N)";A$:IF A$="Y"
THEN GOTO 510 ELSE IF A$="y" GOTO 510 ELSE IF A$="N" GOTO
540 ELSE IF A$="n" GOTO 540 ELSE
530 LOCATE 24,27,1:PRINT "you must enter (y/n) try
again":GOTO 520
540 IF X=7 THEN GOTO 560 ELSE RETURN 110
550 '
560 '
570 '                      *** SECTION 6.2 ***
580 '
590 '
600 CLS:LOCATE 5,30,1:PRINT "*** SECTION 6.2 ***":LOCATE
7,31,1:PRINT "-TYPE OF ENGINES-":LOCATE 10,13,1:INPUT
"ENTER NUMBER OF ENGINES COMPETING FOR SELECTION";ENG
610 CLS:LOCATE 2,27,0:PRINT "ENGINE SELECTION
PARAMETERS":LOCATE 4,5,0:PRINT "ENGINES":LOCATE
6,5,0:PRINT "DRY WEIGHT":PRINT TAB(5) "SHP (ssl)
military":PRINT TAB(5) "SFC (ssl) military":PRINT TAB(5)
"INITIAL COST ($K)"
620 LOCATE 11,5,0:PRINT "OPERATING COST/HR/":PRINT TAB(5)
"ENGINE ($)":LOCATE 14,5,0:PRINT "PREVENTIVE MAINT/"
630 PRINT TAB(5) "HR/ENGINE ($)":LOCATE 17,5,0:PRINT
"MTBMA (hrs)":PRINT TAB(5) "MDT (hrs)":PRINT TAB(5) "MTBF
(hrs)":PRINT TAB(5) "MTBR (hrs)"
640 K=30:KK=28:FOR I=1 TO ENG:IF I=1 THEN A$="A" ELSE IF
I=2 THEN A$="B":ELSE IF I=3 THEN A$="C" ELSE IF I=4 THEN
A$="D" ELSE IF I=5 THEN A$="E"
650 LOCATE 4,K,0:PRINT A$:LOCATE
6,KK,0:INPUT;"",DW(I):LOCATE 7,KK,0:INPUT;"",SHP(I):LOCATE
8,KK,0:INPUT;"",SFC(I):LOCATE 9,KK,0:INPUT;"",IC(I):LOCATE
11,KK,0:INPUT;"",OC(I):LOCATE
14,KK,1:INPUT;"",PMA(I):LOCATE 17,KK,0:INPUT;"",MTBMA(I)
```

```
660 LOCATE 18,KK,0:INPUT;"",MDT(I):LOCATE
19,KK,0:INPUT;"", MTBF(I):LOCATE
20,KK,0:INPUT;"",MTBR(I):K=K+10:KK=KK+10:NEXT I
670 LOCATE 23,33,0:INPUT "ANY CHANGES (Y/N)";A$:IF A$="Y"
THEN GOTO 610 ELSE IF A$="y" GOTO 610 ELSE IF A$="N" GOTO
690 ELSE IF A$="n" GOTO 690 ELSE
680 LOCATE 25,27,0:PRINT "you must enter (y/n) try
again":GOTO 670
690 '
700 '
710 '
720 '
730 CLS:LOCATE 10,10,0:INPUT "ENTER SPECIFICATION AVERAGE
FLIGHT HOURS PER YEAR ";AFL:LOCATE 12,10,0:INPUT "ENTER
SPECIFICATION AVERAGE AIRFRAME SERVICE LIFE IN
YEARS";SL:LOCATE 14,10,0:INPUT "ENTER AVERAGE FLIGHT HOUR
PER FLIGHT";TAV
740 LOCATE 23,33,0:INPUT "ANY CHANGES (Y/N)";A$:IF A$="Y"
THEN GOTO 730 ELSE IF A$="y" GOTO 730 ELSE IF A$="N" GOTO
760 ELSE IF A$="n" GOTO 760 ELSE
750 LOCATE 25,27,0:PRINT "you must enter (y/n) try
again":GOTO 740
760 FOR I=1 TO ENG:YM(I)=PMA(I)*AFL/1000:YO(I)=
OC(I)*AFL/1000:NRPL1=AFL*SL/MTBR(I):NRPL(I)=ENGINE*(CINT(N
RPL1)):LC(I)=ENGINE*(RD(I)+IC(I)+(SL*(YO(I)+YM(I)))+(NRPL(
I)*((1.35*IC(I))-(.8*IC(I))))):AVAIL(I)=MTBMA(I)/(MTBMA(I)
+MDT(I))
770 MAINT(I)=(MDT(I)/(MTBMA(I)+MDT(I)))*TAV:RELY(I)=EXP(-
TAV/MTBF(I)):RC(I)=1.35*IC(I):SV(I)=.8*IC(I):NEXT I:IF X=7
THEN GOTO 790 ELSE RETURN 110
780 '
790 '
800 '                        *** SECTION 6.3 ***
810 '
820 '
830 CLS:LOCATE 5,30,0:PRINT "*** SECTION 6.3 ***":LOCATE
7,29,0:PRINT "-INSTALLATION WEIGHT-"
840 FOR I=1 TO ENG:IF DW(I)<=300 THEN GOTO 850 ELSE IF
DW(I)>300 AND DW(I)<=700 GOTO 860 ELSE IF DW(I)>700 AND
DW(I)<=1100 GOTO 870 ELSE IF DW(I)>1100 GOTO 880
850 EWT(I)=DW(I)*1.29:GOTO 890
860 EWT(I)=DW(I)*1.27:GOTO 890
870 EWT(I)=DW(I)*1.24:GOTO 890
880 EWT(I)=DW(I)*1.2:GOTO 890
890 NEXT I
900 LOCATE 9,25,0:PRINT "ENGINES         INSTALLATION
WEIGHT"
910 K1=11:FOR I=1 TO ENG:IF I=1 THEN A$="A" ELSE IF I=2
THEN A$="B":ELSE IF I=3 THEN A$="C" ELSE IF I=4 THEN
A$="D" ELSE IF I=5 THEN A$="E"
```

```
920 LOCATE K1,28,0:PRINT A$:LOCATE K1,48,0:PRINT
EWT(I):K1=K1+2:NEXT I:IF AV=1 THEN GOTO 930 ELSE GOSUB
1800:IF X=7 THEN GOTO 960 ELSE RETURN 110
930 LCOPY:GOSUB 1800:RETURN
940 '
950 '
960 '                       *** SECTION 6.4 ***
970 '
980 '
990 CLS:LOCATE 3,27,0:PRINT "ENGINE SELECTION
CRITERIA":LOCATE 5,36,0:PRINT "---------------- ENGINE ---
--------------":LOCATE 6,37,0:PRINT "A        B        C
D         E":PRINT "":PRINT "POWERPLANT WEIGHT:":PRINT
"LIFE-CYCLE COST (1000$):"
1000 PRINT TAB(5) "ENGINE LIFE (hrs):":PRINT TAB(5) "No.
OF REPLACEMENTS:":PRINT TAB(5) "R/D COSTS:":PRINT TAB(5)
"INITIAL COSTS:":PRINT TAB(5) "ANNUAL MAINT. COST:":PRINT
TAB(5) "ANNUAL OPERATING COST:":PRINT TAB(5) "REPLACEMENT
COST:"
1010 PRINT TAB(5) "SALVAGE VALUE:":PRINT "AVAILABILITY
(per engine):":PRINT "RELIABILITY (per engine):":PRINT
"MAINTAINABILITY (per engine):":PRINT "PERFORMANCE
(military SHP):":C$="#.####"
1020 K1=35:B$="#####":FOR I=1 TO ENG:LOCATE 8,K1,0:PRINT
USING B$;EWT(I):LOCATE 9,K1,0:PRINT USING B$;LC(I):LOCATE
10,K1,0:PRINT USING B$;MTBR(I):LOCATE 11,K1,0:PRINT USING
B$;NRPL(I):LOCATE 12,K1,0:PRINT USING B$;RD(I):LOCATE
13,K1,0:PRINT USING B$;IC(I)
1030 LOCATE 14,K1,0:PRINT USING B$;YM(I):LOCATE
15,K1,0:PRINT USING B$;YO(I):LOCATE 16,K1,0:PRINT USING
B$;RC(I):LOCATE 17,K1,0:PRINT USING B$;SV(I):LOCATE
18,K1,0:PRINT USING C$;AVAIL(I):LOCATE 19,K1,0:PRINT USING
C$;RELY(I)
1040 LOCATE 20,K1,0:PRINT USING C$;MAINT(I):LOCATE
21,K1,0:PRINT USING B$;SHP(I):K1=K1+9:NEXT I:IF AV=1 THEN
GOTO 1050 ELSE IF X=8 THEN GOSUB 1800:RETURN 1480 ELSE
GOSUB 1800:GOTO 1060
1050 LCOPY:LPRINT CHR$ (12):RETURN 1400
1060 IF ENG=1 THEN EN=1:GOTO 1100 ELSE CLS:LOCATE
10,10,0:INPUT "NOW ENTER THE LETTER OF THE SELECTED ENGINE
(ie. A,B,C)";D$
1070 IF D$="A" THEN EN=1 ELSE IF D$="a" THEN EN=1 ELSE IF
D$="B" THEN EN=2 ELSE IF D$="b" THEN EN=2 ELSE IF D$="C"
THEN EN=3 ELSE IF D$="c" EN=3 ELSE IF D$="D" THEN EN=4
ELSE IF D$="d" THEN EN=4 ELSE IF D$="E" THEN EN=5 ELSE IF
D$="e" THEN EN=5
1080 LOCATE 23,33,0:INPUT "ANY CHANGES (Y/N)";A$:IF A$="Y"
THEN GOTO 1060 ELSE IF A$="y" GOTO 1060 ELSE IF A$="N"
GOTO 1100 ELSE IF A$="n" GOTO 1100 ELSE
1090 LOCATE 25,27,0:PRINT "you must enter (y/n) try
again":GOTO 1060
```

```
1100 IF X=7 THEN GOTO 1150 ELSE RETURN 110
1110 '
1120 '
1130 '                          *** SECTION 6.5 ***
1140 '
1150 '
1160 CLS:LOCATE 5,30,0:PRINT "*** SECTION 6.5 ***":LOCATE
7,28,0:PRINT "-TRANSMISSION SELECTION-"
1170 LOCATE 10,15,0:PRINT "ENGINE SHAFT HORSE POWER
=";ESHP:LOCATE 12,15,0:INPUT "USING TABLE VI-3 SELECT AND
ENTER TRANSMISSION WEIGHT";TRWT:LOCATE 14,15,0:INPUT
"ENTER TRANSMISSION RATING IN SHP";TRPWR
1180 LOCATE 23,33,0:INPUT "ANY CHANGES (Y/N)";A$:IF A$="Y"
THEN GOTO 1170 ELSE IF A$="y" GOTO 1170 ELSE IF A$="N"
GOTO 1200 ELSE IF A$="n" GOTO 1200 ELSE
1190 LOCATE 25,27,0:PRINT "you must enter (y/n) try
again":GOTO 1180
1200 IF X=7 THEN GOTO 1230 ELSE RETURN 110
1210 '
1220 '
1230 '                         *** SECTION 6.6 ***
1240 '
1250 '
1260 CLS:LOCATE 23,1,0:PRINT "~W=COMP/"
1270 W(6,3)=W6C(3)+TRWT+(ENGINE*EWT(EN)):WE2=0:FOR I=1 TO
15:WE2=WE2+W(I,3):NEXT I:NGW=WE2+FUEL+UL+(PEOPLE*250):
NDL=NGW/(PI*R^2):NCT=NGW/(PI*R^2*RHO*OMEGA^2*R^2):NTIPLOSS
=1-(SQR(2*NCT)/B):NPIN=(NGW^1.5)/(SQR(2*RHO*PI*(R^2))*NTIP
LOSS*550)
1280 NPO=(RHO*CDO*SIGMA*PI*(R^5)*(OMEGA^3))/4400
1290
NTRT=(NPIN+NPO)*550/(OMEGA*TL):TA=PI*TR^2:TRVT=OMEGAT*
TR:CTT=NTRT/(RHO*TA*TRVT^2):TTIP=1-(SQR(2*CTT)/BT):
NPITR=NTRT^1.5/(SQR(2*RHO*TA)*TTIP*550):NPOTR=SIGMAT*CDO*R
HO*TA*TRVT^3/4400:NPTTR=NPITR+NPOTR
1300 NP=NPIN+NPO:NPT=NPIN+NPO+NPTTR:HP=NPT:NPINWOTL=NPIN*
NTIPLOSS:NFM=NPINWOTL/NP:NPERINDP=(NPIN/NP)*100:NPERDIFP=(
ABS(NPT-PTT(1,1))/NPT)*100:NPERDIFW=(ABS(NGW-
GW(N))/NGW)*100
1310 CLS:LOCATE 5,30,0:PRINT "*** SECTION 6.6 ***":LOCATE
7,19,0:PRINT "-REVISED GROSS WEIGHT AND POWER REQUIRED-
":LOCATE 10,20,0:PRINT "NEW GROSS WEIGHT =";NGW:LOCATE
12,20,0:PRINT "NEW TOTAL POWER TO HOVER OGE =";NPT
1320 LOCATE 14,20,0:PRINT "NEW DISC LOADING =";NDL:LOCATE
16,20,0:PRINT "NEW FIGURE OF MERIT =";NFM:LOCATE
18,20,0:PRINT "NEW PERCENT OF INDUCED POWER
=";NPERINDP:LOCATE 20,20,0:PRINT "PERCENT DIFFERENCE IN
TOTAL POWER =";NPERDIFP
1330 LOCATE 22,20,0:PRINT "PERCENT DIFFERENCE IN WEIGHT
=";NPERDIFW:GOSUB 1800:RETURN 110
1340 '
```

```
1350 '
1360 '
1370 '                          *** PRINT OUT DATA ***
1380 '
1390 '
1400 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C6PRINT/":INPUT;"",PR:COLOR 15,1,1
1410 IF PR=1 THEN GOSUB 1440:GOTO 1420 ELSE IF PR=2 THEN
GOSUB 1440:GOTO 1430 ELSE IF PR=3 THEN AV=0:RETURN 110
1420 AV=1:GOSUB 1500:AV=0:GOTO 1400
1430 AV=1:GOSUB 990:AV=0:GOTO 1400
1440 CLS:LOCATE 23,1,0:PRINT "~W=PRINTER/":GOSUB
1800:CLS:RETURN
1450 '                          *** PRINT OUT DATA ***
1460 '
1470 '
1480 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C6RESULT/":INPUT;"",PR:COLOR 15,1,1
1490 IF PR=1 THEN GOTO 1500 ELSE IF PR=2 THEN GOSUB 990
ELSE IF PR=3 THEN RETURN 110
1500 IF AV=1 THEN LPRINT TAB(25) "TABLE OF CHAPTER SIX
RESULTS":LPRINT "" ELSE CLS:LOCATE 2,25,1:PRINT "TABLE OF
CHAPTER SIX RESULTS"
1510 IF AV=1 THEN LPRINT TAB(12) "SELECTED ENGINE DATA"
ELSE LOCATE 4,12,1:PRINT "SELECTED ENGINE DATA"
1520 PRINT TAB(17) "DRY WEIGHT";TAB(57) DW(EN)
1530 PRINT TAB(17) "SHP";TAB(57) SHP(EN)
1540 PRINT TAB(17) "SFC";TAB(57) SFC(EN)
1550 PRINT TAB(17) "INITIAL COST";TAB(57) IC(EN)
1560 PRINT TAB(17) "OPERATING COST";TAB(57) OC(EN)
1570 PRINT TAB(17) "PREVENTIVE MAINTENANCE";TAB(57)
PMA(EN)
1580 PRINT TAB(17) "MTBMA";TAB(57) MTBMA(EN)
1590 PRINT TAB(17) "MDT";TAB(57) MDT(EN)
1600 PRINT TAB(17) "MTBR";TAB(57) MTBR(EN)
1610 PRINT TAB(17) "REPLACEMENT COST";TAB(57) RC(EN)
1620 PRINT TAB(17) "SALVAGE COST";TAB(57) SV(EN)
1630 PRINT TAB(17) "AVAILABILITY";TAB(57) AVAIL(EN)
1640 PRINT TAB(17) "RELIABILITY";TAB(57) RELY(EN)
1650 PRINT TAB(17) "MAINTAINABILITY";TAB(57) MAINT(EN)
1660 PRINT TAB(12) "TRANSMISSION RATING (SHP)";TAB(57)
TRPWR
1670 PRINT TAB(12) "TRANSMISSION WEIGHT";TAB(57) TRWT
1680 IF AV=1 THEN GOTO 1690 ELSE GOSUB 1800:GOTO 1690
1690 IF AV=1 THEN PRINT TAB(12) "NEW GROSS WEIGHT";TAB(57)
NGW ELSE CLS:LOCATE 3,12,0:PRINT "NEW GROSS
WEIGHT";TAB(57) NGW
1700 PRINT TAB(17) "TOTAL POWER TO HOVER OGE";TAB(57) NPT
1710 PRINT TAB(17) "DISC LOADING";TAB(57) NDL
1720 PRINT TAB(17) "FIGURE OF MERIT";TAB(57) NFM
```

```
1730 PRINT TAB(17) "PERCENT INDUCED POWER";TAB(57)
NPERINDP
1740 PRINT TAB(17) "PERCENT DIFFERENCE IN POWER";TAB(57)
NPERDIFP
1750 PRINT TAB(17) "PERCENT DIFFERENCE IN WEIGHT";TAB(57)
NPERDIFW
1760 IF AV=1 THEN GOTO 1770 ELSE GOSUB 1800:GOTO 1460
1770 LCOPY:LPRINT CHR$ (12):RETURN 1400
1780 '
1790 '
1800 IF AP=1 THEN LOCATE 25,79,0 ELSE LOCATE 25,27,0:PRINT
"press any key to continue"
1810 A$=INKEY$:IF A$="" THEN 1810
1820 RETURN
```

I. CHAPTER SEVEN

```
10 KEY(5) OFF
20 '***************** CHAPTER SEVEN **********************
30 '
40 '                  RANGE AND ENDURANCE
50 '
60 '****************************************************
70 '
80 '        ***  CHAPTER SEVEN MAIN PROGRAM  ***
90 '
100 '
110 PRINT "~C=ALL/":PRINT "~L=CH7/"
120 KEY(9) ON:ON KEY(9) GOSUB 130
130 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C7MAIN/":INPUT;"",X
140 COLOR 15,1,1:IF X=1 THEN GOSUB 500 ELSE IF X=2 THEN
GOSUB 620 ELSE IF X=3 THEN GOSUB 680 ELSE IF X=4 THEN
GOSUB 750 ELSE IF X=5 THEN GOSUB 840 ELSE IF X=6 THEN
GOSUB 940 ELSE IF X=7 THEN GOSUB 1020 ELSE
150 IF X=8 THEN GOSUB 1120 ELSE IF X=9 THEN GOSUB 500 ELSE
IF X=10 THEN GOSUB 1620 ELSE IF X=11 THEN GOSUB 1900 ELSE
IF X=12 THEN GOSUB 180 ELSE IF X=13 THEN CLS:LOCATE
23,1,0:PRINT "~W=LOAD/":CHAIN "HD1",,ALL
160 '
170 '
180 '           *** STORE DATA ON FILE DISK ***
190 '
200 '
210 CLS:LOCATE 23,1,0:PRINT "~W=DISK/":GOSUB 1940:LOCATE
25,27,1:PRINT "                           ":LOCATE
23,1,0:PRINT "~W=SAVE/"
220 A(1)=SGW:A(2)=GW1:A(3)=WE:A(4)=VTIPMAX:A(5)=R:A(6)=
OMEGA:A(7)=CT:A(8)=SIGMA:A(9)=B:A(10)=C:A(11)=AR:A(12)=CL:
A(13)=CLALPHA:A(14)=CDO:A(15)=DL:A(16)=MBL:A(17)=MU:A(18)=
MAXFVEL:A(19)=TIPLOSS:A(20)=PIN:A(21)=PO:A(22)=PT:A(23)=HP
:A(24)=PERINDP
230 V=24:FOR I=1 TO 3:FOR J=1 TO 15:V=V+1:Q=J+24:A(V)=W(Q-
24,I):NEXT J,I:FOR I=1 TO
3:A(I+69)=W2A(I):A(I+72)=W2B(I):A(I+75)=W6A(I):A(I+78)=W6B
(I):A(I+81)=W6C(I):NEXT
I:A(85)=N:A(86)=WE(N):A(87)=GW(N):A(88)=DL(N-
1):A(89)=FM(N-1):A(90)=FL:A(91)=IRLG
240 A(92)=NW
250 A(93)=PERDIFW:A(94)=PERDIFP:A(95)=Y:A(96)=FUEL:A(97)=
PEOPLE:A(98)=UL:A(99)=SPECIAL:A(100)=ENGINE:A(101)=ZZ:A(10
2)=AB:A(103)=GR:A(104)=RH:A(105)=H:A(106)=D:A(107)=PINI:A(
108)=PTI:A(109)=M:A(110)=EFPA:A(111)=RHO(2):A(112)=MM:A(11
3)=M(2):A(114)=CRUISEV
260 A(115)=CRU:A(116)=CRU2:A(117)=MAXF:A(118)=MAXF2:A(119)
=MAXCRU1:A(120)=ALT:A(121)=TEMP:A(122)=LL:A(123)=TR:A(124)
```

```
=TRPM:A(125)=OMEGAT:A(126)=TCDO:A(127)=BT:A(128)=TAR:A(129
)=TRC:A(130)=TTR:A(131)=CTTR:A(132)=TRB:A(133)=SIGMAT:A(13
4)=V:A(135)=SPAN
270 A(136)=S:A(137)=SWP:A(138)=SWEEP:A(139)=LAVS:A(140)=
VSAR:A(141)=BETA2:A(142)=T:A(143)=T2:A(144)=T3:A(145)=CLAT
R:A(146)=ALTR:A(147)=ALTRDEG:A(148)=TL:A(149)=BLTW:A(150)=
CM:A(151)=THT:A(152)=AM:A(153)=AMAX:A(154)=PINIGE:A(155)=P
TTI:A(156)=RSHP
280 A(157)=STYPE:A(158)=ICESHD:A(159)=STRTIN:A(160)=INLET
:A(161)=BARR:A(162)=PARTSEP:A(163)=EAPS:A(164)=HDIF:A(165)
=INRED:A(166)=EEDS:A(167)=RSHP1:A(168)=RSHP2:A(169)=RSHP3:
A(170)=RSHP1A:A(171)=RSHP2A:A(172)=RSHP3A:A(173)=ESHP:A(17
4)=LOSS:A(175)=ENG
290 A(176)=EN:A(177)=TRPWR:A(178)=TRWT:A(179)=NGW:A(180)
=NPT:A(181)=NDL:A(182)=NFM:A(183)=NPERINDP:A(184)=NPERDIFP
:A(185)=NPERDIFW:FOR I=1 TO 3:A(185+I)=SFC(I):
A(188+I)=SHP(I):A(191+I)=WDOTF(I):NEXT I:A(195)=BETAH:
A(196)=ALPHAH(1):A(197)=ALPHAH(2)
300 A(198)=PHANTOM(1):A(199)=PHANTOM(2):A(200)=MRV:A(201)
=MRP:A(202)=FFR:A(203)=MEV:A(204)=ERSHPR:A(205)=EFFR:A(206
)=CRUPWR(1):A(207)=CRUPWR(2):A(208)=CRUFFR(1):A(209)=CRUFF
R(2):A(210)=TFUEL:A(211)=TIME:A(212)=NGW2:G=213
310 LL=LL+1:FOR I=1 TO LL:A(G)=O(I):G=G+1:NEXT I:G=G+1+LL:
G1=G+1+2*LL:G2=G1+1+2*LL:G3=G2+1+2*LL:G4=G3+1+2*LL
320 FOR I=1 TO 2:FOR J=1 TO LL:A(G)=PINF(I,J):A(G1)=
POF(I,J):A(G2)=PPF(I,J):A(G3)=PTF(I,J):A(G4)=TM(I,J):G=G+1
:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:NEXT J,I
330 G5=G4+2:G6=G5+2:G7=G6+2:FOR I=1 TO 2:A(G4)=PITR(I):
A(G5)=POTR(I):A(G6)=PTTR(I):A(G7)=CLTR(I):G4=G4+1:G5=G5+1:
G6=G6+1:G7=G7+1:NEXT I:G8=G7+1+2*(LL-1):G9=G8+1+2*(LL-1)
340 FOR I=1 TO 2:FOR J=2 TO LL:A(G7)=PITRF(I,J):A(G8)=
POTRF(I,J):A(G9)=PTTRF(I,J):G7=G7+1:G8=G8+1:G9=G9+1:NEXT
J,I:G10=G9+1+2*LL:G11=G10+1+2*LL:G12=G11+1+2*LL:G13=G12+1+
2*LL:G14=G13+1+2*LL
350 FOR I=1 TO 2:FOR J=1 TO LL:A(G9)=TTM(I,J):A(G10)=
TRT(I,J):A(G11)=L(I,J):A(G12)=VERSTAB(I,J):A(G13)=PTTRVSF(
I,J):A(G14)=PITRFI(I,J):G9=G9+1:G10=G10+1:G11=G11+1:G12=G1
2+1:G13=G13+1:G14=G14+1:NEXT J,I
360 G15=G14+1:G16=G15+1+2*LL:G17=G16+1+2*LL:G18=
G17+1+2*LL:G19=G18+1+2*LL:G20=G19+1+2*LL:G21=G20+1+2*LL
370 FOR I=1 TO 2:FOR J=1 TO LL:A(G15)=AL90(I,J):A(G16)=
AL270(I,J):A(G17)=M90(I,J):A(G18)=MCRIT(I,J):A(G19)=PS(I,J
):A(G20)=PM(I,J):A(G21)=PTT(I,J):G15=G15+1:G16=G16+1:G17=G
17+1:G18=G18+1:G19=G19+1:G20=G20+1:G21=G21+1:NEXT J,I
380 G22=G21+1:G23=G22+1+ENG:G24=G23+1+ENG:G25=G24+1+ENG:
G26=G25+1+ENG:G27=G26+1+ENG:G28=G27+1+ENG:G29=G28+1+ENG:G3
0=G29+1+ENG:G31=G30+1+ENG:G32=G31+1+ENG:G33=G32+1+ENG:G34=
G33+1+ENG:G35=G34+1+ENG:G36=G35+1+ENG:G37=G36+1+ENG:G38=G3
7+1+ENG
390 G39=G38+1+ENG:G40=G39+1+ENG:G41=G40+1+ENG
```

```
400 FOR I=1 TO ENG:A(G22)=DW(I):A(G23)=SHP(I):A(G24)=
SFC(I):A(G25)=IC(I):A(G26)=OC(I):A(G27)=PMA(I):A(G28)=MTBM
A(I):A(G29)=MDT(I):A(G30)=MTBF(I):A(G31)=MTBR(I):A(G32)=RC
(I):A(G33)=SV(I):A(G34)=AVAIL(I):A(G35)=RELY(I):A(G36)=MAI
NT(I)
410 A(G37)=LC(I):A(G38)=EWT(I):A(G39)=YO(I):A(G40)=YM(I):
A(G41)=NRPL(I):G22=G22+1:G23=G23+1:G24=G24+1:G25=G25+1:G26
=G26+1:G27=G27+1:G28=G28+1:G29=G29+1:G30=G30+1:G31=G31+1:G
32=G32+1:G33=G33+1:G34=G34+1:G35=G35+1:G36=G36+1
420 G37=G37+1:G38=G38+1:G39=G39+1:G40=G40+1:G41=G41:NEXT I
430 LL(5)=186+(46*LL)+(50*ENG):LL=LL-1
440 Z=7:OPEN "B:DATA1" FOR OUTPUT AS #1:PRINT #1, Z:FOR
I=1 TO 10:PRINT #1, LL(I):NEXT I:CLOSE #1
450 OPEN "B:DATA7" FOR OUTPUT AS #1:FOR I=1 TO LL(5):PRINT
#1, A(I):NEXT I:CLOSE #1:RETURN 120
460 '
470 '
480 '                      *** SECTION 7.1 ***
490 '
500 '
510 '
520 CLS:LOCATE 5,30,1:PRINT "*** SECTION 7.1 ***":LOCATE
7,31,0:PRINT "-FUEL FLOW RATE-":LOCATE 9,25,1:INPUT "ENTER
SFC AT MILITARY POWER";SFC(1):LOCATE 10,25,1:INPUT "ENTER
SHP AT MILITARY POWER";SHP(1)
530 LOCATE 12,25,0:INPUT "ENTER SFC AT NORMAL
POWER";SFC(2):LOCATE 13,25,0:INPUT "ENTER SHP AT NORMAL
POWER";SHP(2):LOCATE 15,25,0:INPUT "ENTER SFC AT CRUISE
POWER";SFC(3):LOCATE 16,25,0:INPUT "ENTER SHP AT CRUISE
POWER";SHP(3)
540 FOR I=1 TO 3:WDOTF(I)=SFC(I)*SHP(I)*ENGINE:NEXT
I:LOCATE 18,25,0:PRINT "FUEL FLOW #FUEL/HR (MILITARY)
=";WDOTF(1):PRINT TAB(25) "FUEL FLOW #FUEL/HR (NORMAL)
=";WDOTF(2):PRINT TAB(25) "FUEL FLOW #FUEL/HR (CRUISE)
=";WDOTF(3)
550 LOCATE 23,30,1:INPUT "ANY CHANGES (Y/N)";A$:IF A$="Y"
THEN GOTO 520 ELSE IF A$="y" GOTO 520 ELSE IF A$="N" GOTO
570 ELSE IF A$="n" GOTO 570 ELSE
560 LOCATE 24,27,1:PRINT "you must enter (y/n) try
again":GOTO 550
570 IF X=9 THEN GOTO 590 ELSE RETURN 120
580 '
590 '
600 '                      *** SECTION 7.2 ***
610 '
620 '
630 CLS:LOCATE 5,30,1:PRINT "*** SECTION 7.2 ***":LOCATE
7,20,1:PRINT "-FUEL FLOW AS A FUNCTION OF HORSEPOWER-"
640 IF SFC(3)=0 THEN BETAH=(WDOTF(1)-WDOTF(2))/(ENGINE*
(SHP(1)-SHP(2))) ELSE BETAH=(WDOTF(1)-WDOTF(3))/(ENGINE*
(SHP(1)-SHP(3)))
```

```
650 ALPHAH=WDOTF(1)-(ENGINE*BETAH*SHP(1)):LOCATE
10,25,0:PRINT "ZERO HORSEPOWER INTERCEPT= ";ALPHAH:GOSUB
1940:IF X=9 THEN GOTO 670 ELSE RETURN 120
660 '
670 '
680 '                        *** SECTION 7.3 ***
690 '
700 '
710 CLS:LOCATE 5,30,0:PRINT "*** SECTION 7.3 ***":LOCATE
7,18,0:PRINT "-FUEL FLOW RATE AT SPECIFICATION CONDITIONS-
":DELTA(1)=1:THETA(1)=1:DELTA(2)=(1-6.87535E-06*ALT)^
5.2561:THETA(2)=(459.688+TEMP)/518.688
720 FOR I=1 TO 2:ALPHAH(I)=ALPHAH*DELTA(I)*SQR(THETA(I))
:NEXT I:LOCATE 10,13,0:PRINT "ZERO HORSEPOWER INTERCEPT AT
SPECIFICATION ALTITUDE =";ALPHAH(2):GOSUB 1940:IF X=9 THEN
GOTO 740 ELSE RETURN 120
730 '
740 '
750 '                       *** SECTION 7.4 ***
760 '
770 '
780 CLS:LOCATE 3,30,0:PRINT "*** SECTION 7.4 ***":LOCATE
5,22,0:PRINT "-ZERO-VELOCITY HORSEPOWER INCREMENT-"
790 FOR I=1 TO 2:PHANTOM(I)=ALPHAH(I)/BETAH:NEXT I:LOCATE
10,25,0:PRINT "PHANTOM HORSEPOWER =";PHANTOM(1):GOSUB
1940:IF X=9 THEN GOTO 820 ELSE RETURN 120
800 '
810 '
820 '                          *** SECTION 7.5 ***
830 '
840 '
850 CLS:LOCATE 5,30,0:PRINT "*** SECTION 7.5 ***":LOCATE
7,28,0:PRINT "-MAXIMUM RANGE VELOCITY-":LOCATE
23,1,0:PRINT "~W=COMP/"
860 GOSUB 1980:BEEP:PRINT "~C=ALL/":LOCATE 10,25,0:PRINT
"MAXIMUM RANGE VELOCITY";MRV:LOCATE 12,25,0:PRINT "SHP FOR
MAXIMUM RANGE VELOCITY =";MRP1:FFR=MRP*BETAH:LOCATE
14,25,0:PRINT "REFERRED HORSEPOWER =";MRP
870 LOCATE 16,25,0:PRINT "FUEL FLOW REQUIRED =";FFR:GOSUB
1940
880 FOR I=1 TO
LL+1:PTT(1,I)=SAVEP(I):O(I)=SAVEV(I):PS(1,I)=SAVEPS(I):PM(
1,I)=SAVEPM(I):NEXT I
890 IF X=9 THEN GOTO 920 ELSE RETURN 120
900 '
910 '
```

```
920 '                          *** SECTION 7.6 ***
930 '
940 '
950 CLS:LOCATE 5,30,0:PRINT "*** SECTION 7.6 ***":LOCATE
7,25,0:PRINT "-MAXIMUM ENDURANCE VELOCITY-":LOCATE
10,22,0:PRINT "ENTER MAXIMUM ENDURANCE VELOCITY =";MEV
960 LOCATE 12,22,0:PRINT "SHP FOR MAXIMUM ENDURANCE
VELOCITY =";PMIN
970 ERSHPR=PHANTOM(1)+PMIN:EFFR=ERSHPR*BETAH:LOCATE
14,22,0:PRINT "REFFERED HORSEPOWER =";ERSHPR:LOCATE
16,22,0:PRINT "FUEL FLOW REQUIRED =";EFFR:GOSUB 1940
980 IF X=9 THEN GOTO 1000 ELSE RETURN 120
990 '
1000 '
1010 '                         *** SECTION 7.7 ***
1020 '
1030 '
1040 CLS:LOCATE 5,30,0:PRINT "***SECTION 7.7 ***":LOCATE
7,18,0:PRINT "-SPECIFICATION CRUISE POWER AND FUEL FLOW-
":LOCATE 23,1,0:PRINT "~W=COMP/":FOR I=1 TO LL:IF
O(I)=CRUISEV THEN II=I:GOTO 1050 ELSE NEXT I
1050 VF1=O(II):FOR U=1 TO 2:GOSUB 1190:NEXT U:FOR I=1 TO
2:CRUPWR(I)=PHANTOM(I)+PTT(I,0):CRUFFR(I)=CRUPWR(I)*BETAH:
NEXT I
1060 PRINT "~C=ALL/":LOCATE 10,15,0:PRINT "CRUISE FUEL
FLOW REQUIRED AT SSL =";CRUFFR(1):LOCATE 12,15,0:PRINT
"CRUISE FUEL FLOW REQUIRED AT SPCECIFICATION ALTITUDE
=";CRUFFR(2):GOSUB 1940:IF X=9 THEN GOTO 1090 ELSE RETURN
120
1070 '
1080 '
1090 '                         *** SECTION 7.8 ***
1100 '
1110 '
1120 CLS:LOCATE 5,30,0:PRINT "*** SECTION 7.8 ***":LOCATE
7,27,0:PRINT "-TOTAL FUEL REQUIREMENTS-":LOCATE
10,23,0:INPUT "ENTER SPECIFICATION MAXIMUM
RANGE";MAXRG:TIME = MAXRG/CRUISEV
1130
TFUEL=(.1*BETAH*(SHP(2)+PHANTOM(1)))+(.25*ERSHPR*BETAH)+(T
IME*CRUFFR(2)):NGW2=NGW-FUEL+TFUEL:LOCATE 12,23,0:PRINT
"TOTAL FUEL REQUIRED =";TFUEL:LOCATE 14,23,0:PRINT "NEW
GROSS WEIGHT =";NGW2:GOSUB 1940:RETURN 120
1140 '
1150 '
1160 '                         *** POWER CALCULATIONS ***
1170 '
1180 '
1190 L=0
1200 'LL=LL+1:FOR I=1 TO 2:FOR J=1 TO
LLL:POF1(I,J)=POF(I,J):PPF1(I,J)=PPF(I,J):PTF1(I,J)=PTF(I,
J):PITRF1(I,J)=PITRF(I,J):POTRF1(I,J)=POTRF(I,J):PTTRF1(I,
J)=PTTRF(I,J):NEXT J,I
1210 RHO(1)=RHO:DA=PI*R^2:VT=OMEGA*R:TRA=PI*TR^2:VH2=GW(N)
/(2*RHO(U)*DA):VF=VF1*1.687778:MU3=VF/VT:CT(U)=GW(N)/(RHO(
U)*DA*VT^2):TIPLOSS(U)=1-(SQR(2*CT(U))/B)
1220 PINF(U,L)=(GW(N)*SQR(((VF^2)/(-VH2*2))+SQR(((VF^2)/
(2*VH2))^2+1))*SQR(VH2))/(550*TIPLOSS(U)):POF(U,L)=(SIGMA*
CDO*RHO(U)*DA*VT^3*(1+4.3*(MU3^2)))/4400:PPF(U,L)=(RHO(U)*
(VF^3)*EFPA)/1100:PTF(U,L)=PINF(U,L)+POF(U,L)+PPF(U,L)
1230 TTR=(((PT*550)/OMEGA)/TL):CTTR=TTR/(PI*(TR^4)*RHO(U)
*(OMEGAT^1.5)):TB(U)=1-((SQR(2*CTTR)/BT)):PITR(U)=
(((TTR^1.5)/SQR(2*PI*(TR^2)*RHO(U)))/TB(U))/550:SIGMAT=(BT
*TRC)/(PI*TR):POTR(U)=(SIGMAT*CDO*RHO(U)*PI*(TR^5)*OMEGAT^
3)/4400:PTTR(U)=PITR(U)+POTR(U)
1240 VF=1.687778*VF1:MU2=VF/(OMEGA*R):VITR=SQR((-(VF^2)/2)
+SQR((((VF^2)/2)^2)+((PTF(U,L)*550)^2)/((2*TRA*RHO(U)*TL*O
MEGA)^2))):PITRF(U,L)=(((PTF(U,L)*550)/(TL*OMEGA))*VITR)/(
550*TB(U))
1250 POTRF(U,L)=SIGMAT*CDO*RHO(U)*TRA*((OMEGAT*TR)^3)*(1+
(4.3*(MU2^2)))/4400:PTTRF(U,L)=PITRF(U,L)+POTRF(U,L)
1270 '
1280 '
1290 MM=M:BB=B:EE=BLTW:THT=EE*PI/180:W=ABS(EE)
1300 M(1)=1116.89
1310 CT=GW(N)/(RHO(U)*DA*VT^2)
1320 B=1-(SQR(2*CT)/BB)
1330
T1=.5*((B^2)+.5*(MU3^2)):T2=((B^3)/3)+(.5*(MU3^2)*B):T3=((
B^2)/4)*(B^2+MU3^2):T4=(.5*MU3)*((B^2)+((MU3^2)/4)):B1=(B^
2-.5*(MU3^2)):A11=4*((MU3*(B^2)/2)-(MU3^3)/8)/((B^2)*B1):
A12=(8*MU3*B)/(3*B1):A13=(2*MU3*(B^2))/B1:A14=(B^2+(3*(MU3
^2))/2)/B
1340 A14=(B^2+(3*MU3^2)/2)/B1:PPF(U,L)=RHO(U)*VF^3*EFPA/2:
IF VF1<40 THEN LAM=SQR(CT/2):PPF(U,L)=PPF(U,L)/550 ELSE
LAM=-(((PPF(U,L))/GW(N))+(GW(N)/(2*RHO(U)*DA*VF)))/VT:
PPF(U,L)=PPF(U,L)/550
1350 F(1)=(2*CT/(SIGMA*CLALPHA))-LAM*T1-THT*T3:F(2)=-
LAM*A11-THT*A13:K(1,1)=T2:K(1,2)=T4:K(2,1)=A12:K(2,2)=
A14:H=2
1360 '
1370 '   SIMULTANEOUS EQUATION SOLVER USING MATRIX
1380 '   DECOMPOSTION WITH FORWARD SUBSTITUTION IN LOWER
1390 '   TRIANGULAR SYSTEM AND BACK-SUBSTITUTION IN UPPER
1400 '   TRIANGULAR SYSTEM
1410 '
1420 '
1430 FOR D=2 TO H:FOR I=1 TO D-1:FOR M=1 TO I-1:K(D,I)
=K(D,I)-(K(D,M)*K(M,I)):K(I,D)=K(I,D)-(K(I,M)*K(M,D)):NEXT
M:K(D,I)=K(D,I)/K(I,I):NEXT I:FOR J=1 TO D-1:K(D,D)=K(D,D)
-(K(D,J)*K(J,D)):NEXT J,D
```

```
1440 FOR I=2 TO H:E=0:FOR J=1 TO I-1:G=K(I,J)*F(J):
E=E+G:NEXT J:F(I)=F(I)-E:NEXT I
1450 F(H)=F(H)/K(H,H):FOR I=H-1 TO 1 STEP -1:P=0:FOR J=I+1
TO H:Q=F(J)*K(I,J):P=P+Q:NEXT J:F(I)=(F(I)-P)/K(I,I):NEXT
I:TH0=F(1):TH2=F(2):FOR I=1 TO 2:F(I)=0:FOR J=1 TO
2:K(I,J)=0:NEXT J,I
1460 AL90(U,L)=(TH0+TH2+THT+(LAM/(1+MU3)))*180/PI:
AL270(U,L)=(TH0-TH2+THT+(LAM/(1+MU3)))*180/PI
1470 '
1480 ACK=AL270(U,L)-AMAX:IF ACK<0 THEN PS(U,L)=0 ELSE
PS(U,L)=(ACK/4)*POF(U,L)
1490 '
1500 '
1510 MTIP=VT/M(U):MU3=VF/VT:M90(U,L)=MTIP*(1+MU3):IF
CAM$="N" OR CAM$="n" THEN MCRIT(U,L)=CM-(2.3*ABS(AL90
(U,L))*PI/180) ELSE MCRIT(U,L)=CM-(2.3*AL90(U,L)*PI/180)
1520 MD=M90(U,L)-MCRIT(U,L)-.06:IF MD<0 THEN PM(U,L)=0
ELSE
PM(U,L)=(((.012*MD)+.1*(MD^3))*SIGMA*RHO(U)*DA*VT^3)/550
1530 '
1540 '
1550 PTT(U,L)=PTF(U,L)+PS(U,L)+PM(U,L)+PTTRF(U,L)
1560 M=MM:B=BB:RETURN
1570 '
1580 '
1590 '                         *** PRINT DATA ***
1600 '
1610 '
1620 IF AT=1 THEN LPRINT TAB(25) "TABLE OF CHAPTER SEVEN
RESULTS" ELSE CLS:LOCATE 2,25,0:PRINT "TABLE OF CHAPTER
SEVEN RESULTS"
1630 LOCATE 4,12,0:PRINT "SFC MILITARY POWER";TAB(57)
SFC(1)
1640 PRINT TAB(12) "SFC NORMAL POWER";TAB(57) SFC(2)
1650 PRINT TAB(12) "SFC CRUISE POWER";TAB(57) SFC(3)
1660 PRINT TAB(12) "SHP MILITARY POWER";TAB(57) SHP(1)
1670 PRINT TAB(12) "SHP NORMAL POWER";TAB(57) SHP(2)
1680 PRINT TAB(12) "SHP CRUISE POWER";TAB(57) SHP(3)
1690 PRINT TAB(12) "FUEL FLOW MILITARY POWER";TAB(57)
WDOTF(1)
1700 PRINT TAB(12) "FUEL FLOW NORMAL POWER";TAB(57)
WDOTF(2)
1710 PRINT TAB(12) "FUEL FLOW CRUISE POWER";TAB(57)
WDOTF(3)
1720 PRINT TAB(12) "ZERO HORSEPOWER INTERCEPT AT
SSL";TAB(57) ALPHAH(1)
1730 PRINT TAB(12) "ZERO HORSEPOWER INTERCEPT AT SPEC.
ALTITUDE";TAB(57) ALPHAH(2)
1740 PRINT TAB(12) "PHANTOM HORSEPOWER AT SSL";TAB(57)
PHANTOM(1)
```

```
1750 PRINT TAB(12) "PHANTOM HORSEPOWER AT SPEC.
ALTITUDE";TAB(57) PHANTOM(2)
1760 IF AT=1 THEN GOTO 1770 ELSE GOSUB 1940
1770 IF AT=1 THEN PRINT TAB(12) "MAXIMUM RANGE
VELOCITY";TAB(57) MRV ELSE CLS:LOCATE 5,12,0:PRINT
"MAXIMUM RANGE VELOCITY";TAB(57) MRV
1780 PRINT TAB(12) "MAXIMUM RANGE REFFERED
HORSEPOWER";TAB(57) MRP
1790 PRINT TAB(12) "MAXIMUM RANGE FUEL FLOW";TAB(57) FFR
1800 PRINT TAB(12) "MAXIMUM ENDURANCE VELOCITY";TAB(57)
MEV
1810 PRINT TAB(12) "MAXIMUM ENDURANCE REFFERED
HORSEPOWER";TAB(57) ERSHPR
1820 PRINT TAB(12) "MAXIMUM ENDURANCE FUEL FLOW";TAB(57)
EFFR
1830 PRINT TAB(12) "CRUISE FUEL FLOW AT SSL";TAB(57)
CRUFFR(1)
1840 PRINT TAB(12) "CRUISE FUEL FLOW AT SPEC.
ALTITUDE";TAB(57) CRUFFR(2)
1850 PRINT TAB(12) "TOTAL FUEL REQUIRED";TAB(57) TFUEL
1860 PRINT TAB(12) "NEW GROSS WEIGHT";TAB(57) NGW2
1870 IF AT=1 THEN LCOPY:LPRINT CHR$ (12):AT=0:RETURN 120
ELSE GOSUB 1940:RETURN 120
1880 '
1890 '
1900 '                    *** HARD COPY OF DATA ***
1910 '
1920 '
1930 CLS:LOCATE 23,1,0:PRINT "~W=PRINTER/":GOSUB
1940:CLS:AT=1:GOSUB 1620:AT=0:RETURN 120
1940 LOCATE 25,27,0:PRINT "press any key to continue"
1950 '
1960 A$=INKEY$:IF A$="" THEN 1960
1970 RETURN
1980 '
1990 '
2000 '                *** MAXIMUM ENDURANCE CALCULATIONS ***
2010 '
2020 '
2030 FOR I=1 TO
LL+1:SAVEP(I)=PTT(1,I):SAVEV(I)=O(I):SAVEPS(I)=PS(1,I):SAV
EPM(I)=PM(1,I):NEXT I
2040 VMIN=PTT(1,1):II=1:FOR I=2 TO LL:IF PTT(1,I)<VMIN
THEN VMIN=PTT(1,I):II=I
2050 NEXT I
2060 PMIN=VMIN:U=1:MEV=O(II):FOR T=1 TO
19:U=1:VF1=O(II)+T:L=T:GOSUB 1210:IF PTT(1,T)<PMIN THEN
PMIN=PTT(1,T):MEV=VF1
2070 NEXT T
2080 FOR T=1 TO 19:VF1=O(II)-T:L=T:GOSUB 1210:IF
PTT(1,L)<PMIN THEN PMIN=PTT(1,L):MEV=VF1
```

```
2090 NEXT T
2100 '
2110 '
2120 '
2130 '
2140 '              *** MAXIMUM RANGE CALCULATIONS ***
2150 '
2160 '
2170 '
2180 VEL=MAXFVEL-MEV:JJ=1:ANG(JJ-1)=200:FOR JJ=1 TO
VEL:L=1:U=1:VF1=MEV+JJ:GOSUB
1210:PWR=PHANTOM(1)+PTT(1,1):ANG(JJ)=PWR/VF1
2190 IF ANG(JJ)<ANG(JJ-1) THEN MRP=PWR:MRP1=PWR-
PHANTOM(1):MRV=VF1 ELSE GOTO 2210
2200 NEXT JJ
2210 RETURN
```

J. CHAPTER EIGHT

```
10 KEY(5) OFF
20 '****************** CHAPTER EIGHT *********************
30 '
40 '              MISCELLANEOUS CALCULATIONS
50 '
60 '******************************************************
70 '
80 '           ***  CHAPTER EIGHT MAIN PROGRAM  ***
90 '
100 '
110 CLS:PRINT "~C=ALL/":PRINT "~L=CH8/"
120 KEY(9) ON:ON KEY(9) GOSUB 130
130 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C8MAIN/":INPUT;"",X
140 COLOR 15,1,1:IF X=1 THEN GOSUB 520 ELSE IF X=2 THEN
GOSUB 650 ELSE IF X=3 THEN GOSUB 770 ELSE IF X=4 THEN
GOSUB 920 ELSE IF X=5 THEN GOSUB 1100 ELSE IF X=6 THEN
GOSUB 520 ELSE IF X=7 THEN GOSUB 1630 ELSE
150 IF X=8 THEN GOSUB 1820 ELSE IF X=9 THEN GOSUB 220 ELSE
IF X=10 THEN CLS:LOCATE 23,1,0:PRINT "~W=LOAD/":CHAIN
"HD1",,ALL
160 LOCATE 23,54,1:PRINT "                    ":GOTO 140
170 '
180 '
190 '             *** STORE DATA ON FILE DISK ***
200 '
210 '
220 CLS:LOCATE 23,1,0:PRINT "~W=DISK/":GOSUB 1850:LOCATE
25,27,1:PRINT "                            ":LOCATE
23,1,0:PRINT "~W=SAVE/"
230 A(1)=SGW:A(2)=GW1:A(3)=WE:A(4)=VTIPMAX:A(5)=R:
A(6)=OMEGA:A(7)=CT:A(8)=SIGMA:A(9)=B:A(10)=C:A(11)=AR:A(12
)=CL:A(13)=CLALPHA:A(14)=CDO:A(15)=DL:A(16)=MBL:A(17)=MU:A
(18)=MAXFVEL:A(19)=TIPLOSS:A(20)=PIN:A(21)=PO:A(22)=PT:A(2
3)=HP:A(24)=PERINDP
240 V=24:FOR I=1 TO 3:FOR J=1 TO 15:V=V+1:Q=J+24:A(V)=W(Q-
24,I):NEXT J,I:FOR I=1 TO 3:A(I+69)=W2A(I):A(I+72)=W2B(I):
A(I+75)=W6A(I):A(I+78)=W6B(I):A(I+81)=W6C(I):NEXT
I:A(85)=N:A(86)=WE(N):A(87)=GW(N):A(88)=DL(N-1):
A(89)=FM(N-1):A(90)=FL:A(91)=IRLG
250 A(92)=NW
260 A(93)=PERDIFW:A(94)=PERDIFP:A(95)=Y:A(96)=FUEL:
A(97)=PEOPLE:A(98)=UL:A(99)=SPECIAL:A(100)=ENGINE:A(101)=Z
Z:A(102)=AB:A(103)=GR:A(104)=RH:A(105)=H:A(106)=D:A(107)=P
INI:A(108)=PTI:A(109)=M:A(110)=EFPA:A(111)=RHO(2):A(112)=M
M:A(113)=M(2):A(114 )=CRUISEV
270 A(115)=CRU:A(116)=CRU2:A(117)=MAXF:A(118)=MAXF2:
A(119)=MAXCRU1:A(120)=ALT:A(121)=TEMP:A(122)=LL:A(123)=TR:
A(124)=TRPM:A(125)=OMEGAT:A(126)=TCDO:A(127)=BT:A(128)=TAR
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:A(129)=TRC:A(130)=TTR:A(131)=CTTR:A(132)=TRB:A(133)=SIGMA
T:A(134)=V:A(135)=SPAN
280 A(136)=S:A(137)=SWP:A(138)=SWEEP:A(139)=LAVS:
A(140)=VSAR:A(141)=BETA2:A(142)=T:A(143)=T2:A(144)=T3:A(14
5)=CLATR:A(146)=ALTR:A(147)=ALTRDEG:A(148)=TL:A(149)=BLTW:
A(150)=CM:A(151)=THT:A(152)=AM:A(153)=AMAX:A(154)=PINIGE:A
(155)=PTTI:A(156)=RSHP
290 A(157)=STYPE:A(158)=ICESHD:A(159)=STRTIN:A(160)=INLET:
A(161)=BARR:A(162)=PARTSEP:A(163)=EAPS:A(164)=HDIF:A(165)=
INRED:A(166)=EEDS:A(167)=RSHP1:A(168)=RSHP2:A(169)=RSHP3:A
(170)=RSHP1A:A(171)=RSHP2A:A(172)=RSHP3A:A(173)=ESHP:A(174
)=LOSS:A(175)=ENG
300 A(176)=EN:A(177)=TRPWR:A(178)=TRWT:A(179)=NGW:
A(180)=NPT:A(181)=NDL:A(182)=NFM:A(183)=NPERINDP:A(184)=NP
ERDIFP:A(185)=NPERDIFW:FOR I=1 TO
3:A(185+I)=SFC(I):A(188+I)=SHP(I):A(191+I)=WDOTF(I):NEXT
I:A(195)=BETAH:A(196)=ALPHAH(1):A(197)=ALPHAH(2)
310 A(198)=PHANTOM(1):A(199)=PHANTOM(2):A(200)=MRV:
A(201)=MRP:A(202)=FFR:A(203)=MEV:A(204)=ERSHPR:A(205)=EFFR
:A(206)=CRUPWR(1):A(207)=CRUPWR(2):A(208)=CRUFFR(1):A(209)
=CRUFFR(2):A(210)=TFUEL:A(211)=TIME:A(212)=NGW2:A(213)=PTF
1:A(214)=PDGW2
320 A(215)=DIF:A(216)=NGW3:A(217)=MCV:A(218)=VVERT:
A(219)=MHA:A(220)=SC:A(221)=BW:A(222)=BH:A(223)=FL:A(224)=
VEFPA:A(225)=MCSHP:A(226)=T2FUEL:A(227)=LS4:G=228
330 LL=LL+1:FOR I=1 TO LL:A(G)=0(I):G=G+1:NEXT
I:G=G+1+LL:G1=G+1+2*LL:G2=G1+1+2*LL:G3=G2+1+2*LL:G4=G3+1+2
*LL
340 FOR I=1 TO 2:FOR J=1 TO LL:A(G)=PINF(I,J):
A(G1)=POF(I,J):A(G2)=PPF(I,J):A(G3)=PTF(I,J):A(G4)=TM(I,J)
:G=G+1:G1=G1+1:G2=G2+1:G3=G3+1:G4=G4+1:NEXT J,I
350 G5=G4+2:G6=G5+2:G7=G6+2:FOR I=1 TO 2:A(G4)=PITR(I):
A(G5)=POTR(I):A(G6)=PTTR(I):A(G7)=CLTR(I):G4=G4+1:G5=G5+1:
G6=G6+1:G7=G7+1:NEXT I:G8=G7+1+2*(LL-1):G9=G8+1+2*(LL-1)
360 FOR I=1 TO 2:FOR J=2 TO LL:A(G7)=PITRF(I,J):
A(G8)=POTRF(I,J):A(G9)=PTTRF(I,J):G7=G7+1:G8=G8+1:G9=G9+1:
NEXT J,I:G10=G9+1+2*LL:G11=G10+1+2*LL:G12=G11+1+2*LL:
G13=G12+1+2*LL:G14=G13+1+2*LL
370 FOR I=1 TO 2:FOR J=1 TO LL:A(G9)=TTM(I,J):
A(G10)=TRT(I,J):A(G11)=L(I,J):A(G12)=VERSTAB(I,J):A(G13)=P
TTRVSF(I,J):A(G14)=PITRFI(I,J):G9=G9+1:G10=G10+1:G11=G11+1
:G12=G12+1:G13=G13+1:G14=G14+1:NEXT J,I
380 G15=G14+1:G16=G15+1+2*LL:G17=G16+1+2*LL:G18=
G17+1+2*LL:G19=G18+1+2*LL:G20=G19+1+2*LL:G21=G20+1+2*LL
390 FOR I=1 TO 2:FOR J=1 TO LL:A(G15)=AL90(I,J):A(G16)=
AL270(I,J):A(G17)=M90(I,J):A(G18)=MCRIT(I,J):A(G19)=PS(I,J
):A(G20)=PM(I,J):A(G21)=PTT(I,J):G15=G15+1:G16=G16+1:G17=G
17+1:G18=G18+1:G19=G19+1:G20=G20+1:G21=G21+1:NEXT J,I
400 G22=G21+1:G23=G22+1+ENG:G24=G23+1+ENG:G25=G24+1+ENG:
G26=G25+1+ENG:G27=G26+1+ENG:G28=G27+1+ENG:G29=G28+1+ENG:G3
0=G29+1+ENG:G31=G30+1+ENG:G32=G31+1+ENG:G33=G32+1+ENG:G34=
G33+1+ENG:G35=G34+1+ENG:G36=G35+1+ENG:G37=G36+1+ENG:G38=G3
7+1+ENG
410 G39=G38+1+ENG:G40=G39+1+ENG:G41=G40+1+ENG
420 FOR I=1 TO
ENG:A(G22)=DW(I):A(G23)=SHP(I):A(G24)=SFC(I):
A(G25)=IC(I):A(G26)=OC(I):A(G27)=PMA(I):A(G28)=MTBMA(I):A(
G29)=MDT(I):A(G30)=MTBF(I):A(G31)=MTBR(I):A(G32)=RC(I):A(G
33)=SV(I):A(G34)=AVAIL(I):A(G35)=RELY(I):A(G36)=MAINT(I)
430 A(G37)=LC(I):A(G38)=EWT(I):A(G39)=YO(I):A(G40)=YM(I):
A(G41)=NRPL(I):G22=G22+1:G23=G23+1:G24=G24+1:G25=G25+1:G26
=G26+1:G27=G27+1:G28=G28+1:G29=G29+1:G30=G30+1:G31=G31+1:G
32=G32+1:G33=G33+1:G34=G34+1:G35=G35+1:G36=G36+1
440 G37=G37+1:G38=G38+1:G39=G39+1:G40=G40+1:G41=G41+1:NEXT
I
450 LL(6)=230+(47*LL)+(50*ENG):LL=LL-1
460 Z=8:OPEN "B:DATA1" FOR OUTPUT AS #1:PRINT #1, Z:FOR
I=1 TO 10:PRINT #1, LL(I):NEXT I:CLOSE #1
470 OPEN "B:DATA8" FOR OUTPUT AS #1:FOR I=1 TO LL(6):PRINT
#1, A(I):NEXT I:CLOSE #1:RETURN 120
480 '
490 '
500 '                *** SECTION 8.1 ***
510 '
520 '
530 '
540 CLS:LOCATE 3,30,1:PRINT "*** SECTION 8.1 ***":LOCATE
5,24,0:PRINT "-DESIGN GROSS AND EMPTY WEIGHT-":LOCATE
1,1,0:PRINT "~W=COMP/":PDGW=(ABS(GW(N)-NGW2)/NGW2)*100:
EW1=GW(N)-(PEOPLE*250)-FUEL-UL:EW2=NGW2-(PEOPLE*250)-
TFUEL-UL:PDEW=(ABS(EW1-EW2)/EW2)*100
550 G1=GW(N):GW(N)=NGW2:VF1=0:U=1:L=0:VF1=0:GOSUB
1210:GW(N)=G1:PTF1=PTF1(1)+PTTR1(1):PRINT "~C=ALL/":LOCATE
7,10,0:PRINT "HOVER POWER FOR DESIGN GROSS WEIGHT
=";PTF1:PDGW2=(ABS(GW(N)-NGW2)/NGW2)*100
560 LOCATE 9,10,0:PRINT "PERCENT DIFFERENCE IN DESIGN
GROSS WEIGHT =";PDGW2
570 DIF=SGW-NGW2:LOCATE 11,10,0:PRINT "DIFFERENCE IN
DESIGN AND SPECIFICATION GROSS WEIGHT =";DIF:LOCATE
13,10,0:PRINT "OPTIONS ARE:":LC=UL+DIF:LOCATE
15,15,0:PRINT "1.  CHANGE INTERNAL LOAD CAPACITY TO";LC
580 FW=TFUEL+DIF:NRANGE=CRUISEV*((FW)-(.1*BETAH*(SHP(2)+
PHANTOM(1)))-(.25*ERSHPR*BETAH))/(CRUFFR(2)):LOCATE
16,15,0:PRINT "2.  CHANGE FUEL WEIGHT TO";FW;"WITH RANGE
OF";NRANGE:LOCATE 17,19,0:PRINT "FROM FUEL WEIGHT
OF";TFUEL
590 LOCATE 19,10,0:PRINT "PRESENT GROSS
WEIGHT";NGW2:LOCATE 20,10,1:INPUT;"ENTER GROSS
WEIGHT",NGW3:LOCATE 21,10,0:INPUT;"ENTER USEFUL LOAD
",UL:LOCATE 22,10,0:INPUT;"ENTER FUEL WEIGHT ",T2FUEL
600 IF X=6 THEN GOTO 620 ELSE RETURN 120
610 '
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```
620 '
630 '                    *** SECTION 8.2 ***
640 '
650 '
660 CLS:LOCATE 5,31,1:PRINT "*** SECTION 8.2 ***":LOCATE
7,29,1:PRINT "-MAXIMUM RATE OF CLIMB-":LOCATE 23,1,0:PRINT
"~W=COMP/"
670 MCSHP=100000!:FOR T=1 TO 21:U=1:VF1=MEV+T-
1:MRC=1:GOSUB 1210:MRC=0:MCS=PTT1(1)+.006*PINF1(1):IF
MCS<MCSHP THEN MCSHP=MCS:MCV=VF1
680 NEXT T
690 FOR T=1 TO 20:U=1:VF1=MEV-T:MRC=1:GOSUB
1210:MRC=0:MCS=PTT1(1)+.006*PINF1(1):IF MCS<MCSHP THEN
MCSHP=MCS:MCV=VF1
700 NEXT T
710 LS3=((((ENGINE*SHP(2))-10)/(1+INLET))/(1+EAPS))/
(1+EEDS)
720 IF ENGINE=1 THEN LS4=LS3/1.03:GOTO 730 ELSE IF
ENGINE=2 THEN LS4=(LS3/1.1)/1.03:GOTO 730 ELSE IF ENGINE=3
THEN LS4=((LS3/1.15)/1.03)/1.01333333#:GOTO 730
730 FOR I=1 TO 3:SOUND 700,9:SOUND 500,9:NEXT I:PRINT
"~C=LAST/":LOCATE 10,25,0:PRINT "MAXIMUM RATE OF CLIMB
AIRSPEED =";MCV:VVERT=66000!*(LS4-MCSHP)/NGW3
740 LOCATE 14,35,0:PRINT "             ":LOCATE
12,25,0:PRINT "MAXIMUM RATE OF CLIMB =";VVERT;"fpm":GOSUB
1850:IF X=6 THEN GOTO 760 ELSE RETURN 120
750 '
760 '
770 '                    *** SECTION 8.3 ***
780 '
790 '
800 CLS:LOCATE 5,30,0:PRINT "*** SECTION 8.3 ***":LOCATE
7,25,0:PRINT "-MAXIMUM HOVER ALTITUDE, IGE-":LOCATE
23,1,0:PRINT
"~W=COMP/":VF1=0:G1=GW(N):GW(N)=NGW3:AL(1)=7120:PA=1:PR(U)
=0:U=0
810 LS=(((((ENGINE*SHP(2))-10)/(1+INLET))/(1+EAPS))/
(1+EEDS))
820 IF ENGINE=1 THEN PTASL=LS/1.03:GOTO 830 ELSE IF
ENGINE=2 THEN PTASL=(LS/1.1)/1.03:GOTO 830 ELSE IF
ENGINE=3 THEN PTASL=((LS/1.15)/1.03)/1.01333333#:GOTO 830
830 K1=6.87535E-06:D=2*R:H=RH+5
840 IF (PA-PR(U))>.01 THEN U=U+1:GOTO 870 ELSE AL(U)=AL(U-
1):AL1=1:GOTO 870
850 IF (PA-PR(U))>.01 THEN U=U+1:GOTO 870 ELSE AL(U)=AL(U-
1):AL1=2:GOTO 870
860 IF (PA-PR(U))>.01 THEN U=U+1:GOTO 870 ELSE GOTO 890
870 THETA=1-(K1*AL(U)):DELTA=(1-
(K1*AL(U)))^5.2561:RHO(U)=RHO*((1-K1*AL(U))^4.2561):GOSUB
1210:PA=PTASL*DELTA*SQR(THETA):PINIA=((-.1276*((H/D)^4)+
.708*((H/D)^3)-1.4569*((H/D)^2)+1.3432*(H/D)+.5147)*
PINF1(U)):PR(U)=PINIA+POF1(U)+PTTR1(U)
880 IF AL1=1 THEN AL(U+1)=AL(U)+100:GOTO 850 ELSE IF AL1=2
THEN AL(U+1)=AL(U)+10:GOTO 860 ELSE
AL(U+1)=AL(U)+1000:GOTO 840
890 MHA=AL(U):FOR I=1 TO 3:SOUND 700,9:SOUND 500,9:NEXT
I:PRINT "~C=ALL/":LOCATE 10,25,0:PRINT "MAXIMUM HOVER
ALTITUDE =";MHA:GOSUB 1850:IF X=6 THEN GOTO 940 ELSE
RETURN 120
900 '
910 '
920 '                    *** SECTION 8.4 ***
930 '
940 '
950 CLS:LOCATE 3,30,0:PRINT "*** SECTION 8.4 ***":LOCATE
5,31,0:PRINT "-SERVICE CEILING-":LOCATE 23,1,0:PRINT
"~W=COMP/":U=0:PA=1:PR(0)=0
960 LS=(((((ENGINE*SHP(2))-10)/(1+INLET))/(1+EAPS))
/(1+EEDS))
970 IF ENGINE=1 THEN PTASL=LS/1.03:GOTO 980 ELSE IF
ENGINE=2 THEN PTASL=(LS/1.1)/1.03:GOTO 980 ELSE IF
ENGINE=3 THEN PTASL=((LS/1.15)/1.03)/1.01333333#:GOTO 980
980 K1=6.87535E-06:ALA(1)=7120:VF1=MCV:TV=NGW3*(100/60)
/550:AL1=0
990 IF (PA-PR(U))>.01 THEN U=U+1:GOTO 1020 ELSE
ALA(U)=ALA(U-1):AL1=1:GOTO 1020
1000 IF (PA-PR(U))>.01 THEN U=U+1:GOTO 1020 ELSE
ALA(U)=ALA(U-1):AL1=2:GOTO 1020
1010 IF (PA-PR(U))>.01 THEN U=U+1:GOTO 1020 ELSE GOTO 1040
1020 THETA=1-(K1*ALA(U)):DELTA=(1-(K1*ALA(U)))^
5.2561:RHO(U)=RHO*((1-K1*ALA(U))^4.2561):MRC=1:GOSUB
1210:MRC=0:PPF2=.006*PINF1(U):PA=PTASL*DELTA*SQR(THETA):PR
(U)=PTT1(U)+PPF2+TV
1030 IF AL1=1 THEN ALA(U+1)=ALA(U)+100:GOTO 1000 ELSE IF
AL1=2 THEN ALA(U+1)=ALA(U)+10:GOTO 1010 ELSE
ALA(U+1)=ALA(U)+1000:GOTO 990
1040
DA=R^2*PI:VI=SQR(GW(N)/(2*RHO(1)*DA)):CT=GW(N)/(RHO(1)*DA*
(OMEGA*R)^2):TIPLOSS=1-(SQR(2*CT)/B):PI=GW(N)^1.5/
(SQR(2*RHO(1)*DA)*TIPLOSS)
1050 VEFPA=(.012*PI)/(RHO(1)*VI^3):SC=ALA(U):FOR I=1 TO
3:SOUND 700,9:SOUND 500,9:NEXT I:PRINT "~C=ALL/":LOCATE
10,28,0:PRINT "SERVICE CEILING =";SC:GOSUB 1850:IF X=6
THEN GOTO 1100 ELSE RETURN 120
1060 '
1070 '
1080 '                    *** SECTION 8.5 ***
1090 '
1100 '
1110 CLS:LOCATE 5,30,0:PRINT "*** SECTION 8.5 ***":LOCATE
7,32,0:PRINT "-FUSELAGE SIZING-"
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1120 IF M=1 THEN BW=7.5:BH=4.5 ELSE IF M=2 THEN
BW=8:BH=4.5 ELSE IF M=3 THEN BW=8:BH=5.4 ELSE IF M=4 THEN
BW=8:BH=8.5 ELSE IF M=5 THEN BW=8.5:BH=8.5 ELSE IF M=6
THEN BW=8.899999:BH=8.899999
1130 IF UL<5000 THEN FL=1.5*TL ELSE FL=1.34*TL
1140 LOCATE 10,30,0:PRINT "BODY WIDTH =";BW:LOCATE
12,30,0:PRINT "BODY HEIGHT =";BH:LOCATE 14,30,0:PRINT
"FUSELAGE LENGTH =";FL:GOSUB 1850:RETURN 120
1150 '
1160 '
1170 '               *** POWER CALCULATIONS ***
1180 '
1190 '
1200 '
1210 RHO(1)=RHO:DA=PI*R^2:VT=OMEGA*R:TRA=PI*TR^2:
VH2=GW(N)/(2*RHO(U)*DA):VF=VF1*1.687778:MU3=VF/VT:CT=GW(N)
/(RHO(U)*DA*VT^2):TIPLOSS=1-(SQR(2*CT)/B)
1220 PINF1(U)=(GW(N)*SQR(((VF^2)/(-VH2*2))+SQR(((VF^2)/
(2*VH2))^2+1))*SQR(VH2))/(550*TIPLOSS):POF1(U)=(SIGMA*CDO*
RHO(U)*DA*VT^3*(1+4.3*(MU3^2)))/4400:PPF1(U)=(RHO(U)*(VF^3
)*EFPA)/1100:PTF1(U)=PINF1(U)+POF1(U)+PPF1(U)
1230 TTR=(((PT*550)/OMEGA)/TL):CTTR=TTR/(PI*(TR^4)*
RHO(U)*(OMEGAT^1.5)):TB=1-((SQR(2*CTTR)/BT)):PITR1(U)=
(((TTR^1.5)/SQR(2*PI*(TR^2)*RHO(U)))/TB)/550:SIGMAT=(BT*TR
C)/(PI*TR):POTR1(U)=(SIGMAT*CDO*RHO(U)*PI*(TR^5)*OMEGAT^3)
/4400:PTTR1(U)=PITR1(U)+POTR1(U)
1240 IF MRC=1 THEN GOTO 1250 ELSE RETURN
1250 VF=1.687778*VF1:MU2=VF/(OMEGA*R):VITR=SQR((-(VF^2)/2)
+SQR((((VF^2)/2)^2)+((PTF1(U)*550)^2)/((2*TRA*RHO(U)*TL*OM
EGA)^2))):PITRF2(U)=(((PTF1(U)*550)/(TL*OMEGA))*VITR)/(550
*TB)
1260 POTRF2(U)=SIGMAT*CDO*RHO(U)*TRA*((OMEGAT*TR)^3)*
(1+(4.3*(MU2^2)))/4400:PTTRF1(U)=PITRF2(U)+POTRF2(U)
1280 '
1290 '
1300 MM=M:BB=B:EE=BLTW:THT=EE*PI/180:W=ABS(EE)
1310 M(1)=1116.89
1320 CT=GW(N)/(RHO(U)*DA*VT^2)
1330 B=1-(SQR(2*CT)/BB)
1340
T1=.5*((B^2)+.5*(MU3^2)):T2=((B^3)/3)+(.5*(MU3^2)*B):T3=((
B^2)/4)*(B^2+MU3^2):T4=(.5*MU3)*((B^2)+((MU3^2)/4)):B1=(B^
2-.5*(MU3^2)):A11=4*((MU3*(B^2)/2)-(MU3^3)/8)/((B^2)*B1):
A12=(8*MU3*B)/(3*B1):A13=(2*MU3*(B^2))/B1:A14=(B^2+(3*(MU3
^2))/2)/B
1350 A14=(B^2+(3*MU3^2)/2)/B1:PPF1(U)=RHO(U)*VF^3*EFPA/2:
IF VF1<40 THEN LAM=SQR(CT/2):PPF1(U)=PPF1(U)/550 ELSE
LAM=-(((PPF1(U))/GW(N))+(GW(N)/(2*RHO(U)*DA*VF)))/VT:
PPF1(U)=PPF1(U)/550
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1360 F(1)=(2*CT/(SIGMA*CLALPHA))-LAM*T1-THT*T3:F(2)=-
LAM*A11-THT*A13:K(1,1)=T2:K(1,2)=T4:K(2,1)=A12:K(2,2)=
A14:H=2
1370 '
1380 '   SIMULTANEOUS EQUATION SOLVER USING MATRIX
1390 '   DECOMPOSTION WITH FORWARD SUBSTITUTION IN LOWER
1400 '   TRIANGULAR SYSTEM AND BACK-SUBSTITUTION IN UPPER
1410 '   TRIANGULAR SYSTEM
1420 '
1430 '
1440 FOR D=2 TO H:FOR I=1 TO D-1:FOR M=1 TO I-1:K(D,I)=
K(D,I)-(K(D,M)*K(M,I)):K(I,D)=K(I,D)-(K(I,M)*K(M,D)):NEXT
M:K(D,I)=K(D,I)/K(I,I):NEXT I:FOR J=1 TO D-1:K(D,D)=K(D,D)
-(K(D,J)*K(J,D)):NEXT J,D
1450 FOR I=2 TO H:E=0:FOR J=1 TO I-1:G=K(I,J)*F(J):
E=E+G:NEXT J:F(I)=F(I)-E:NEXT I
1460 F(H)=F(H)/K(H,H):FOR I=H-1 TO 1 STEP -1:P=0:FOR J=I+1
TO H:Q=F(J)*K(I,J):P=P+Q:NEXT J:F(I)=(F(I)-P)/K(I,I):NEXT
I:TH0=F(1):TH2=F(2):FOR I=1 TO 2:F(I)=0:FOR J=1 TO
2:K(I,J)=0:NEXT J,I
1470 AL901(U)=(TH0+TH2+THT+(LAM/(1+MU3)))*180/PI:AL2701(U)
=(TH0-TH2+THT+(LAM/(1+MU3)))*180/PI
1480 '
1490 ACK=(AL2701(U)-AMAX):IF ACK<0 THEN PS1(U)=0 ELSE
PS1(U)=(ACK/4)*POF1(U)
1500 '
1510 '
1520 MTIP=VT/M(1):MU3=VF/VT:M901(U)=MTIP*(1+MU3):IF
CAM$="N" OR CAM$="n" THEN MCRIT1(U)=CM-
(2.3*ABS(AL901(U))*PI/180) ELSE MCRIT1(U)=CM-
(2.3*AL901(U)*PI/180)
1530 MD=M901(U)-MCRIT1(U)-.06:IF MD<0 THEN PM1(U)=0 ELSE
PM1(U)=(((.012*MD)+.1*(MD^3))*SIGMA*RHO(U)*DA*VT^3)/550
1540 '
1550 '
1560 PTT1(U)=PTF1(U)+PS1(U)+PM1(U)+PTTRF1(U)
1570 M=MM:B=BB:RETURN
1580 '
1590 '
1600 '                    *** PRINT DATA ***
1610 '
1620 '
1630 IF AT=1 THEN LPRINT TAB(25) "TABLE OF CHAPTER EIGHT
RESULTS" ELSE CLS:LOCATE 2,25,0:PRINT "TABLE OF CHAPTER
EIGHT RESULTS"
1640 LOCATE 4,12,0:PRINT "HOVER POWER FOR DESIGN GROSS
WEIGHT";TAB(57) PTF1
1650 PRINT TAB(12) "PERCENT DIFFERENCE IN DESIGN GROSS
WEIGHT";TAB(57) PDGW2
1660 PRINT TAB(12) "DIFFERENCE IN DESIGN AND SPEC. GROSS
WEIGHT";TAB(57) DIF
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1670 PRINT TAB(12) "NEW GROSS WEIGHT";TAB(57) NGW3
1680 PRINT TAB(12) "MAXIMUM RATE OF CLIMB
AIRSPEED";TAB(57) MCV
1690 PRINT TAB(12) "MAXIMUM RATE OF CLIMB";TAB(57) VVERT
1700 PRINT TAB(12) "MAXIMUM RATE OF CLIMB POWER
AVAILABLE";TAB(57) LS4
1710 PRINT TAB(12) "MAXIMUM HOVER ALTITUDE, IGE";TAB(57)
MHA
1720 PRINT TAB(12) "SERVICE CEILING";TAB(57) SC
1730 PRINT TAB(12) "BODY WIDTH";TAB(57) BW
1740 PRINT TAB(12) "BODY HEIGHT";TAB(57) BH
1750 PRINT TAB(12) "FUSELAGE LENGTH";TAB(57) FL
1760 IF AT=1 THEN LCOPY:LPRINT CHR$ (12):AT=0:GOTO 120
ELSE GOSUB 1850:RETURN 120
1770 '
1780 '
1790 '              *** HARD COPY OF DATA ***
1800 '
1810 '
1820 CLS:LOCATE 23,1,0:PRINT "~W=PRINTER/":GOSUB
1850:CLS:AT=1:GOSUB 1630:AT=0:RETURN 120
1830 '
1840 '
1850 LOCATE 25,27,0:PRINT "press any key to continue"
1860 '
1870 A$=INKEY$:IF A$="" THEN 1870
1880 RETURN
```

K. CHAPTER NINE

```
10 '******************** CHAPTER NINE ********************
20 '
30 '               FINAL PERFORMANCE CHECKS
40 '
50 '******************************************************
60 '
70 '          ***  CHAPTER NINE MAIN PROGRAM  ***
80 '
90 '
100 CLS:PRINT "~C=ALL/":PRINT "~L=CH9/"
110 COLOR 1,1,1:CLS:LOCATE 23,1,0:PRINT
"~W=C9MAIN/":INPUT;"",X
120 COLOR 15,1,1:IF X=1 THEN GOSUB 160 ELSE IF X=2 THEN
GOSUB 620 ELSE
130 IF X=3 THEN CLS:LOCATE 25,27,0:PRINT "~W=LOAD/":CHAIN
"HD1",,ALL
140 '
150 '
160 '                      *** LIST FINAL SUMMARY ***
170 '
180 '
190 CLS:LOCATE 10,20,0:INPUT "ENTER SPECIFICATION SERVICE
CEILING";SSC:LOCATE 12,20,0:INPUT "ENTER SPECIFICATION
HOVER CEILING";SHC:LOCATE 14,20,0:INPUT "ENTER
SPECIFICATION ROTOR RADIUS";SR
200 LOCATE 16,20,0:INPUT "ENTER SPECIFICATION MAXIMUM RATE
OF CLIMB";SMRC:LOCATE 18,20,0:INPUT "ENTER SPECIFICATION
FUSELAGE LENGTH";SFL:LOCATE 20,20,0:INPUT "ENTER ENGINE
TYPE (ie. T58-GE-10)";TYPE$
210 LOCATE 23,27,0:INPUT "ANY CHANGES (Y/N)";A$:IF A$="Y"
THEN GOTO 190 ELSE IF A$="y" GOTO 190 ELSE IF A$="N" GOTO
230 ELSE IF A$="n" GOTO 230 ELSE
220 LOCATE 25,27,0:PRINT "you must enter (y/n) try
again":GOTO 210
230 LLL=LL+1:FOR I=1 TO LLL:IF PS(2,I)>0 THEN II=I ELSE
NEXT I
240 EWT=NGW-(PEOPLE*250)-UL-FUEL:GAS=T2FUEL:IF AX=1 THEN
GOTO 660
250 CLS:LOCATE 2,33,0:PRINT "FINAL SUMMARY":LOCATE
4,32,0:PRINT "* PERFORMANCE *":LOCATE 6,43,0:PRINT
"SPECIFICATION           DESIGN"
260 PRINT "CREW:";TAB(46) PEOPLE;TAB(67) PEOPLE
270 PRINT "INTERNAL LOAD (lbs):";TAB(46) UL;TAB(67) UL
280 PRINT "SERVICE CEILING (ft):";TAB(46) SSC;TAB(67) SC
290 PRINT "HOVER CEILING (ft):";TAB(46) SHC;TAB(67) MHA
300 PRINT "VELOCITY (kts) CRUISE:";TAB(46) CRUISEV;TAB(67)
CRUISEV
310 PRINT TAB(16) "MAXIMUM:";TAB(46) MAXFVEL;TAB(67)
MAXFVEL
```

```
320 PRINT TAB(16) "MAX ENDURANCE:";TAB(67) MEV
330 PRINT TAB(16) "MAX RANGE:";TAB(67) MRV
340 PRINT TAB(16) "BLADE STALL ON-SET:";TAB(67) O(II)
350 PRINT "MAX RATE OF CLIMB (FT/MIN):";TAB(46)
SMRC;TAB(67) VVERT
360 PRINT "ENGINE -      NUMBER:";TAB(67) ENGINE
370 PRINT TAB(16) "TYPE:";TAB(67) TYPE$
380 PRINT TAB(16) "SHP (ssl) MILITARY:";TAB(67) SHP(1)
390 IF AX=1 THEN LOCATE 21,34,0:PRINT "* GEOMETRY *":GOTO
400 ELSE GOSUB 1010:CLS:LOCATE 2,34,0:PRINT "* GEOMETRY
*":LOCATE 4,43,0:PRINT "SPECIFICATION          DESIGN"
400 PRINT "WEIGHT (lbs)   MAX GROSS:";TAB(46) SGW;TAB(67)
NGW3
410 PRINT TAB(16) "EMPTY:";TAB(67) EWT
420 PRINT "FUEL CAPACITY (lbs):";TAB(67) GAS
430 PRINT "MAIN ROTOR -   CHORD (ft):";TAB(67) C
440 PRINT TAB(16) "RADIUS (ft):";TAB(46) SR;TAB(67) R
450 PRINT TAB(16) "NUMBER OF BLADES:";TAB(67) B
460 PRINT TAB(16) "DRAG COEFFICIENT:";TAB(67) CDO
470 PRINT TAB(16) "ROTATIONAL VEL (rad/sec):";TAB(67)
OMEGA
480 PRINT TAB(16) "SOLIDITY:";TAB(67) SIGMA
490 PRINT "TAIL ROTOR -   CHORD (ft):";TAB(67) TRC
500 PRINT TAB(16) "RADIUS (ft):";TAB(67) TR
510 PRINT TAB(16) "NUMBER OF BLADES:";TAB(67) BT
520 PRINT TAB(16) "DRAG COEFFICIENT:";TAB(67) CDO
530 PRINT TAB(16) "ROTATIONAL VEL (rad/sec):";TAB(67)
OMEGAT
540 PRINT TAB(16) "SOLIDITY:";TAB(67) SIGMAT
550 PRINT TAB(16) "VERTICAL TAIL AREA (ft2):";TAB(67) S
560 PRINT "FUSELAGE LENGTH (ft):";TAB(46) SFL;TAB(67) FL
570 PRINT "EFPA (ft2) -   FORWARD:";TAB(67) EFPA
580 PRINT TAB(16) "VERTICAL:";TAB(67) VEFPA
590 IF AX=1 THEN LCOPY:LPRINT CHR$ (12):GOTO 110 ELSE
GOSUB 1010:GOTO 110
600 '
610 '
620 '                          *** PRINT RESULTS ***
630 '
640 '
650 AX=1:GOSUB 160
660 CLS:LOCATE 10,25,0:PRINT "~W=PRINTER/":GOSUB
1010:LOCATE 25,27,0:PRINT "                          "
670 AX=0:LPRINT "":LPRINT "":LPRINT TAB(33) "FINAL
SUMMARY":LPRINT "":LPRINT TAB(32) "* PERFORMANCE *":LPRINT
"":LPRINT "":LPRINT TAB(43) "SPECIFICATION
DESIGN"
680 LPRINT "CREW:";TAB(46) PEOPLE;TAB(67) PEOPLE
690 LPRINT "INTERNAL LOAD (lbs):";TAB(46) UL;TAB(67) UL
700 LPRINT "SERVICE CEILING (ft):";TAB(46) SSC;TAB(67) SC
710 LPRINT "HOVER CEILING (ft):";TAB(46) SHC;TAB(67) MHA
```

```
720 LPRINT "VELOCITY (kts) CRUISE:";TAB(46)
CRUISEV;TAB(67) CRUISEV
730 LPRINT TAB(16) "MAXIMUM:";TAB(46) MAXFVEL;TAB(67)
MAXFVEL
740 LPRINT TAB(16) "MAX ENDURANCE:";TAB(67) MEV
750 LPRINT TAB(16) "MAX RANGE:";TAB(67) MRV
760 LPRINT TAB(16) "BLADE STALL ON-SET:";TAB(67) O(II)
770 LPRINT "MAX RATE OF CLIMB (FT/MIN):";TAB(46)
SMRC;TAB(67) VVERT
780 LPRINT "ENGINE -       NUMBER:";TAB(67) ENGINE
790 LPRINT TAB(16) "TYPE:";TAB(67) TYPE$
800 LPRINT TAB(16) "SHP (ssl) MILITARY:";TAB(67) SHP(1)
810 LPRINT "":LPRINT TAB(33) "* GEOMETRY *":LPRINT ""
820 LPRINT "WEIGHT (lbs)   MAX GROSS:";TAB(46) SGW;TAB(67)
NGW3
830 LPRINT TAB(16) "EMPTY:";TAB(67) EWT
840 LPRINT "FUEL CAPACITY (lbs):";TAB(67) GAS
850 LPRINT "MAIN ROTOR -   CHORD (ft):";TAB(67) C
860 LPRINT TAB(16) "RADIUS (ft):";TAB(46) SR;TAB(67) R
870 LPRINT TAB(16) "NUMBER OF BLADES:";TAB(67) B
880 LPRINT TAB(16) "DRAG COEFFICIENT:";TAB(67) CDO
890 LPRINT TAB(16) "SOLIDITY:";TAB(67) SIGMA
900 LPRINT "TAIL ROTOR -   CHORD (ft):";TAB(67) TRC
910 LPRINT TAB(16) "RADIUS (ft):";TAB(67) TR
920 LPRINT TAB(16) "NUMBER OF BLADES:";TAB(67) BT
930 LPRINT TAB(16) "DRAG COEFFICIENT:";TAB(67) CDO
940 LPRINT TAB(16) "ROTATIONAL VEL (rad/sec):";TAB(67)
OMEGAT
950 LPRINT TAB(16) "SOLIDITY:";TAB(67) SIGMAT
960 LPRINT TAB(16) "VERTICAL TAIL AREA (ft2):";TAB(67) S
970 LPRINT "FUSELAGE LENGTH (ft):";TAB(46) SFL;TAB(67) FL
980 LPRINT "EFPA (ft2) -   FORWARD:";TAB(67) EFPA
990 LPRINT TAB(16) "VERTICAL:";TAB(67) VEFPA
1000 LPRINT CHR$ (12):RETURN 110
1010 LOCATE 25,27,0:PRINT "press any key to continue"
1020 A$=INKEY$:IF A$="" THEN 1020
1030 RETURN
```

L. CHAPTER TEN

```
10 '******************** CHAPTER TEN **********************
20 '
30 '               *** COST ESTIMATION ***
40 '
50 '
60 '           *** CHAPTER TEN MAIN PROGRAM ***
70 '
80 '
90 CLS:PRINT "~C=ALL/":PRINT "~L=CH10/"
100 COLOR 1,1,1:AZ=0:CLS:LOCATE 23,1,0:PRINT
"~W=C10MAIN/":INPUT;"",X
110 COLOR 15,1,1:IF X=1 THEN GOSUB 150 ELSE IF X=2 THEN
GOSUB 340 ELSE
120 IF X=3 THEN CLS:LOCATE 23,1,0:PRINT "~W=LOAD/":CHAIN
"HD1",,ALL
130 '
140 '
150 CLS:LOCATE 10,20,1:INPUT "ENTER PRODUCTION
QUANTITY";Q:LOCATE 12,20,0:INPUT "ENTER INFLATION
RATE";IFR
160 LOCATE 22,32,1:INPUT "ANY CHANGES (Y/N)";A$:IF A$="y"
THEN GOTO 150 ELSE IF A$="Y" GOTO 150 ELSE IF A$="n" GOTO
420 ELSE IF A$="N" GOTO 420 ELSE
170 LOCATE 23,27,1:PRINT "you must enter (y/n) try
again":LOCATE 22,50,1:PRINT "              ":GOTO 160
180 '
190 '
200 '           *** PRINT COST ESTIMATION TABLE ***
210 '
220 '
230 CLS:LOCATE 2,30,1:PRINT "COST ESTIMATION TABLE":LOCATE
4,42,1:PRINT "              COST":LOCATE 6,1,1:PRINT "1.
ROTOR:";TAB(55) C(1)
240 PRINT "2.  TAIL  ROTOR:";TAB(55) C2A(1):PRINT "
STRUCTURE:";TAB(55) C2B(1):PRINT "3.  BODY:";TAB(55) C(3)
250 PRINT "4.  LANDING GEAR:";TAB(55) C(4):PRINT "5.
NACELLE:";TAB(55) C(5)
260 PRINT "6.  PROPULSION ENGINE:";TAB(55) C6A(1):PRINT
TAB(16) "DRIVE:";TAB(55) C6B(1):PRINT TAB(16) "FUEL
TANKS:";TAB(55) C6C(1)
270 PRINT "7.  FLIGHT CONTROLS:";TAB(55) C(7):PRINT "8.
AUXILLARY POWER:";TAB(55) C(8):PRINT "9.
INSTRUMENTS:";TAB(55) C(9)
280 PRINT "10. HYDRAULICS:";TAB(55) C(10):PRINT "11.
ELECTRICAL:";TAB(55) C(11):PRINT "12. AVIONICS:";TAB(55)
C(12):PRINT "13. FURNISHINGS:"
290 LOCATE 21,55,1:PRINT C(13):PRINT "14. AIR &
ICE:";TAB(55) C(14):PRINT "15. LOAD & HANDLING:";TAB(55)
C(15)
```

```
300 CE(1)=0:FOR I=1 TO 15:CE(I+1)=C(I)+CE(I):NEXT I:LOCATE
24,30,0:PRINT "TOTAL COST =";CE(16)
310 IF AZ=1 THEN LCOPY:LPRINT CHR$ (12):GOTO 100 ELSE
GOSUB 350:GOTO 100
320 '
330 '
340 CLS:LOCATE 23,1,0:PRINT "~W=PRINTER/":GOSUB
350:AZ=1:GOSUB 150
350 LOCATE 25,27,0:PRINT "press any key to continue"
360 '
370 A$=INKEY$:IF A$="" THEN 370
380 RETURN
390 '                *** COST ESTIMATING ***
400 '
410 '
420 '          ***  COST ESTIMATION CALCULATION  ***
430 '
440 '
450 C(1) = (-12938+101*W(1,3)*Q^-.074)*IFR
460 C2A(1) = (102*W2A(3)*Q^-.074)*IFR
470 C2B(1) = (759*(W2B(3)^.848)*Q^-.286)*IFR:C(2)=
C2A(1)+C2B(1)
480 C(3) = (860*(W(3,3)^.848)*Q^-.286)*IFR
490 IF GR=1 THEN C(4) = IFR*C(3)*W(4,3)/W(3,3) ELSE C(4) =
IFR*85*W(4,3)*(Q^-.2176)
500 C(5) = IFR*893*(W(5,3)^.848)*(Q^-.286)
510 C6A(1) = IC(EN)*IFR*ENGINE*1000
520 C6B(1) = (19946 + (83*W6B(3)*(Q^-.074)))*IFR
530 C6C(1) = IFR*201*W6C(3)*(Q^-8.959999E-02):
C(6)=C6A(1)+C6B(1)+C6C(1)
540 C(7) = IFR*156*W(7,3)*(Q^-8.959999E-02)
550 C(8) = IFR*243*W(8,3)*(Q^-8.959999E-02)
560 C(9) = IFR*125*W(9,3)*(Q^-8.959999E-02)
570 C(10) = IFR*91*W(10,3)*(Q^-8.959999E-02)
580 C(11) = IFR*143*W(11,3)*(Q^-8.959999E-02)
590 C(12) = IFR*(6847+(125*W(12,3)*(Q^-8.959999E-02)))
600 C(13) = IFR*69*W(13,3)*(Q^-8.959999E-02)
610 C(14) = IFR*213*W(14,3)*(Q^-8.959999E-02)
620 C(15) = IFR*C(3)*W(15,3)/W(3,3)
630 RETURN 220
640 '
650 '
```

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